INTERAVIA

REVIEW OF WORLD AVIATION

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Nerve Centres of Air Politics

VOLUME VII 12 1952

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Executive Editors: P. A. Blackburn, E. Herzfeld, H. Rieck
Associate Editors: A. de Rham, J. M. Stroud, J. Jenni, E. Baur, A. Arbex, Ginés de Bracamonte
Art Editor: H. W. Mahrer
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Front Cover:

One of the "nerve centres of international air politics" lies in the Middle East, the defence of which has yet to be organized. The problems involved are amongst those discussed in this issue. — The picture shows the catalytic cracking plant at Abadan Refinery, South Persia, still a subject of litigation between the AIOC, the British and Iranian Governments and indeed a "focal point" in its own right.

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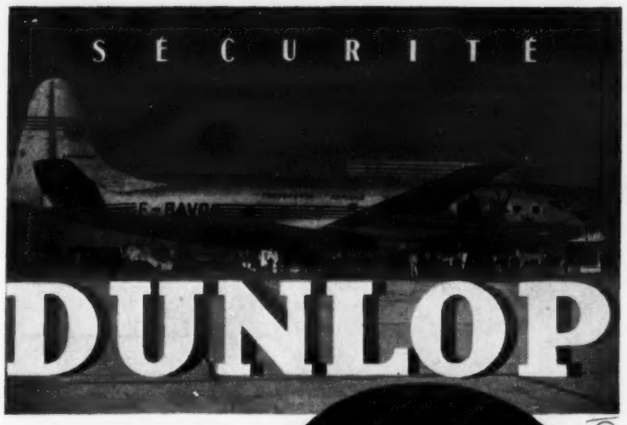

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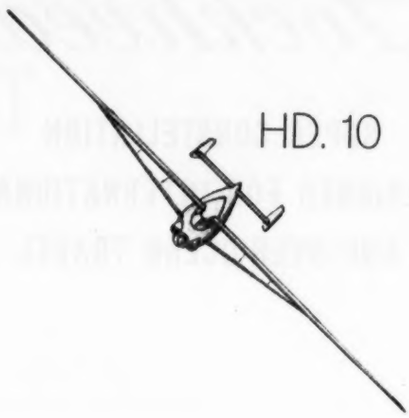

HD. 10

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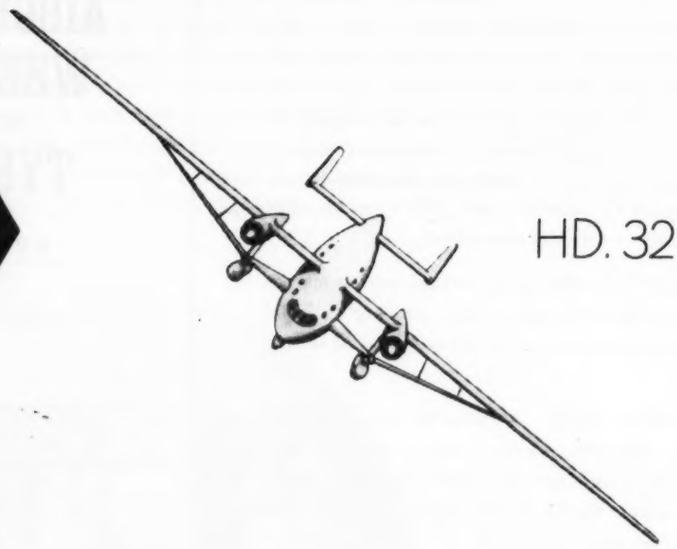

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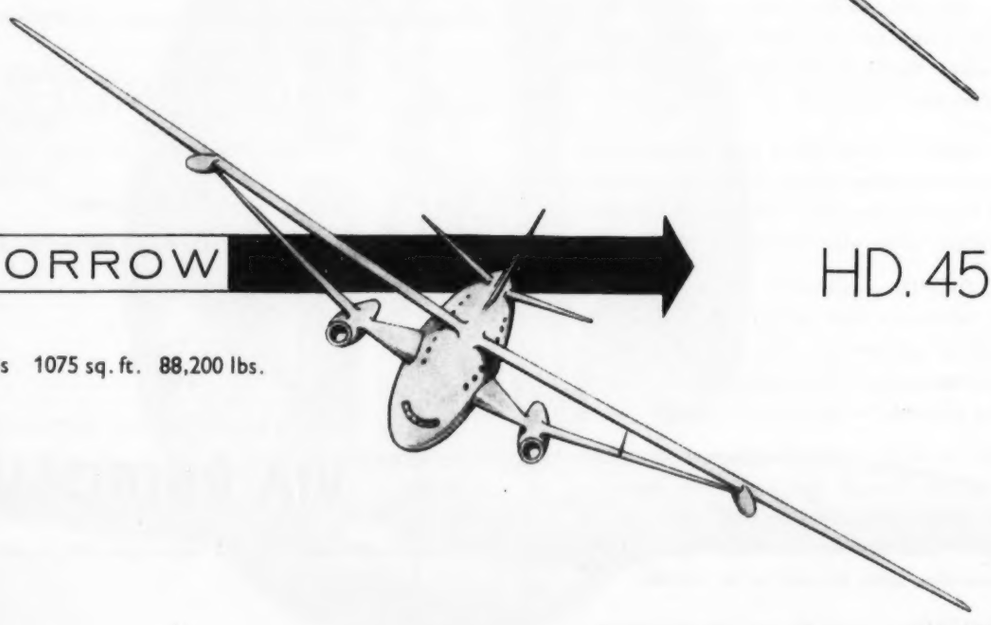

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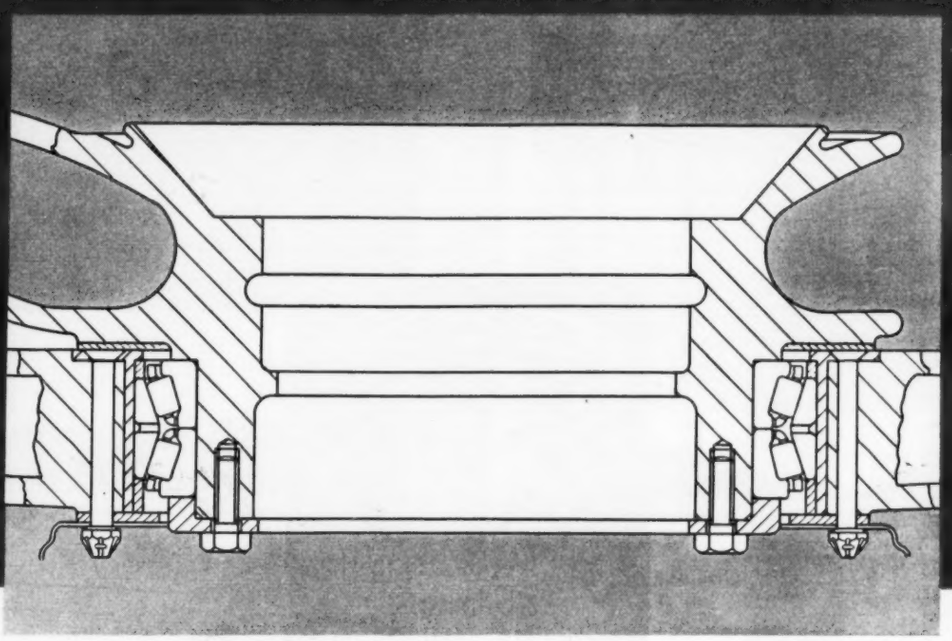

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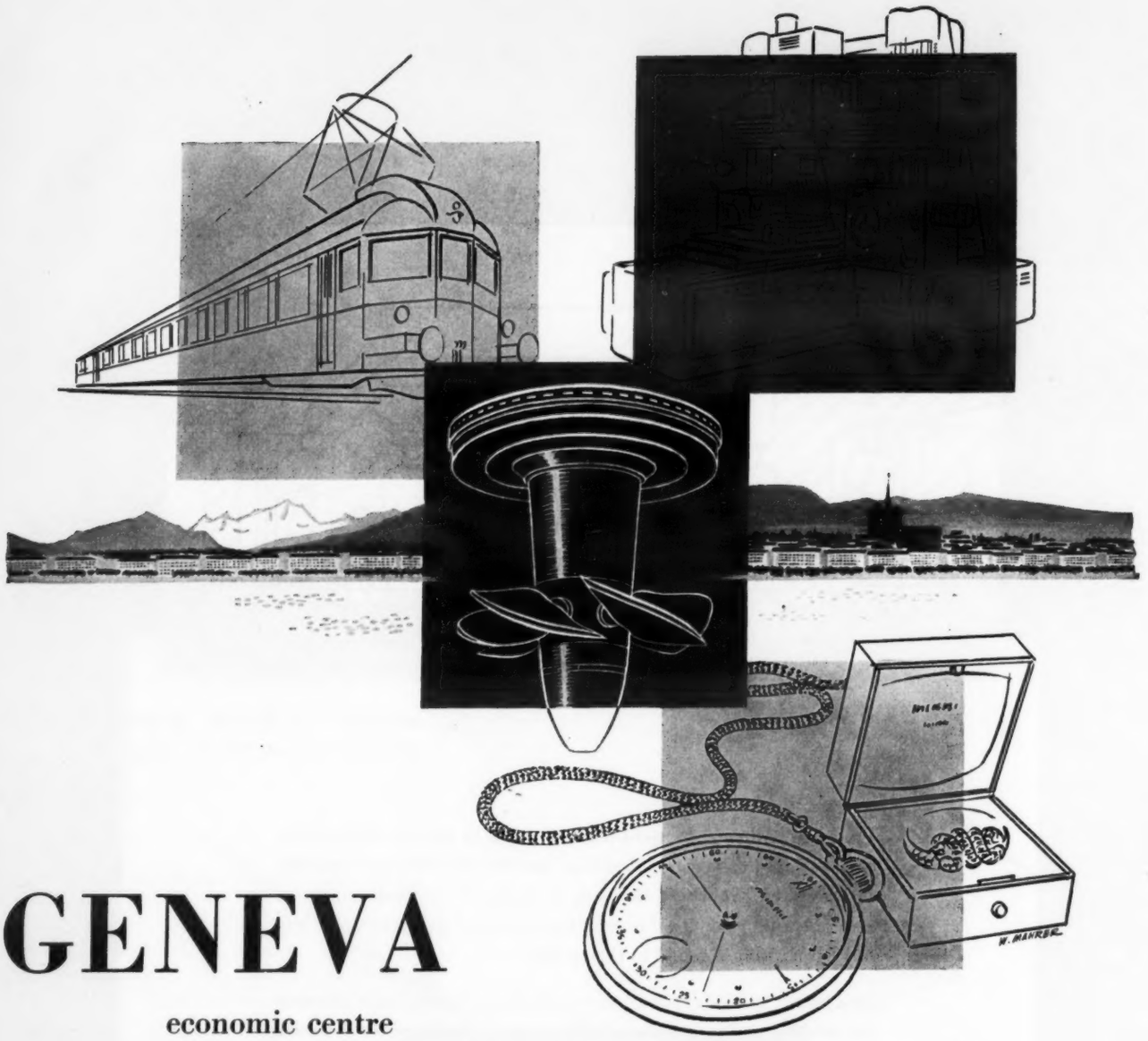

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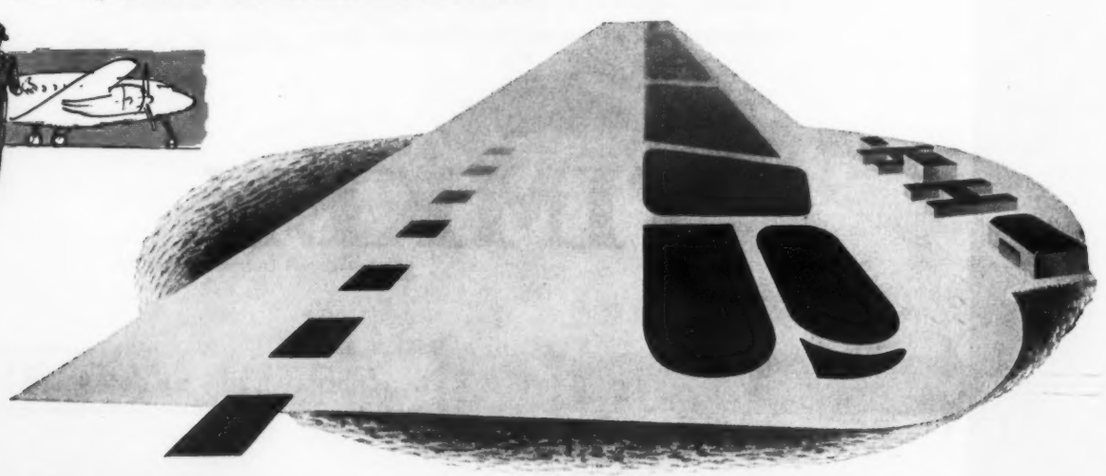
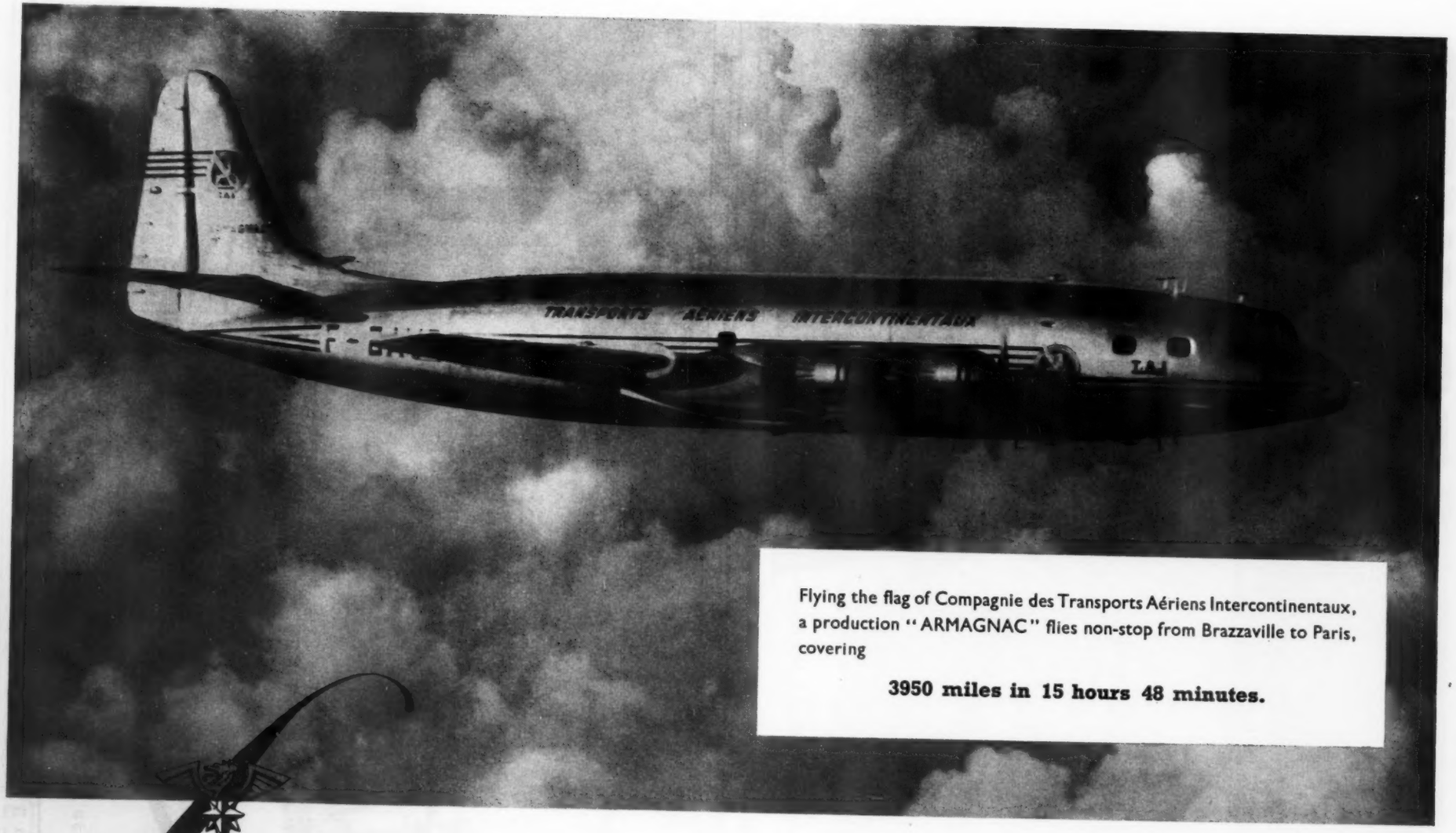


GENEVA INTERCONTINENTAL AIRPORT



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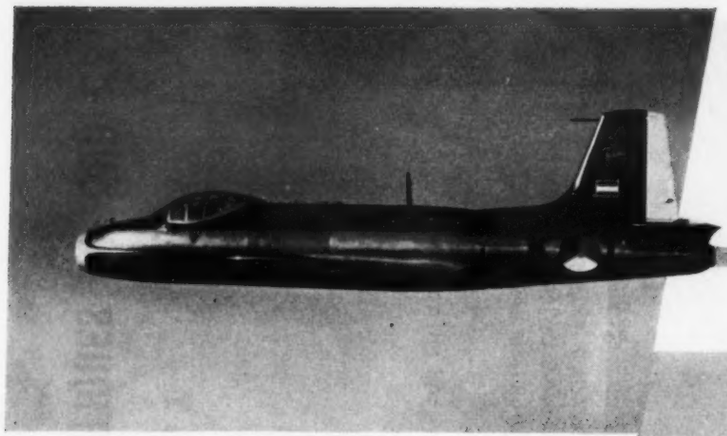

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Gen. I. A. Aler, C.o.S. Dutch Air Force in an interview:
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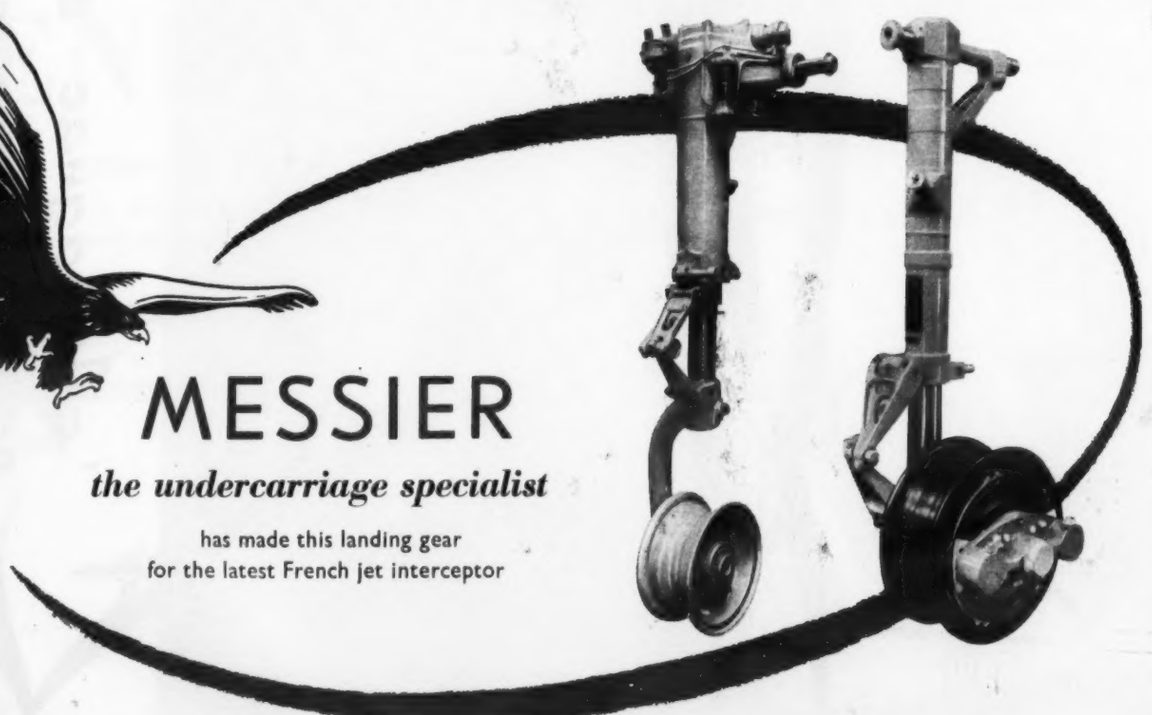

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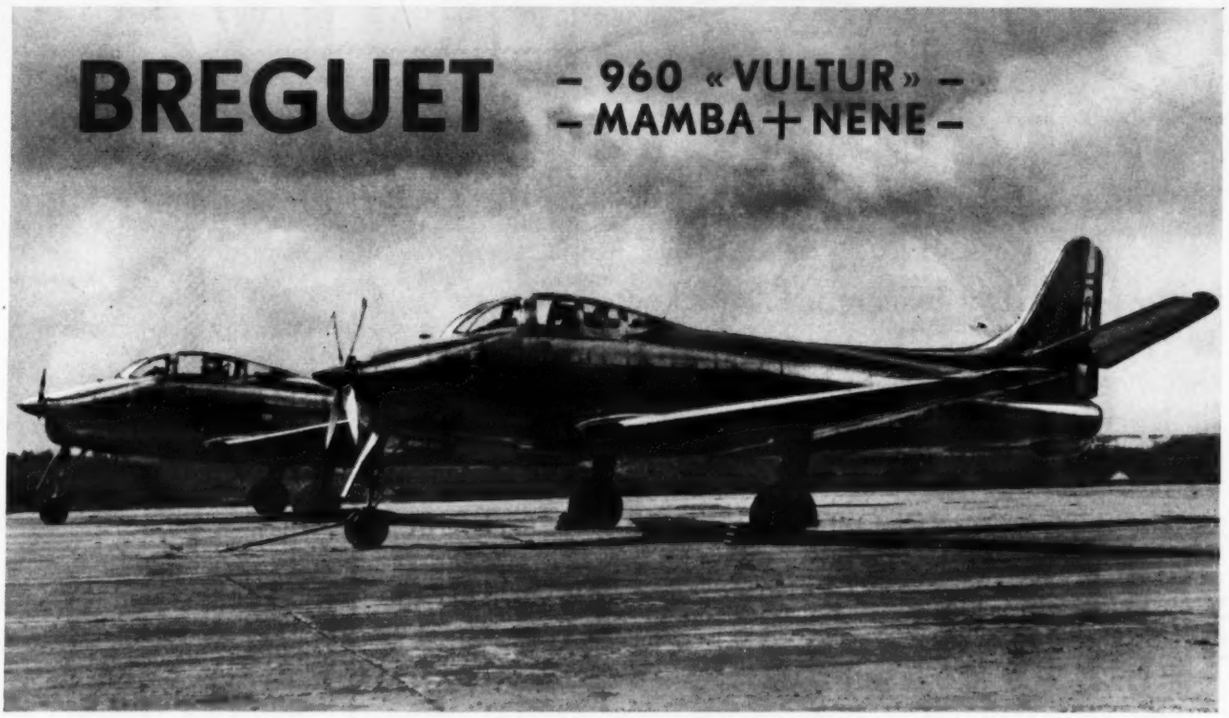

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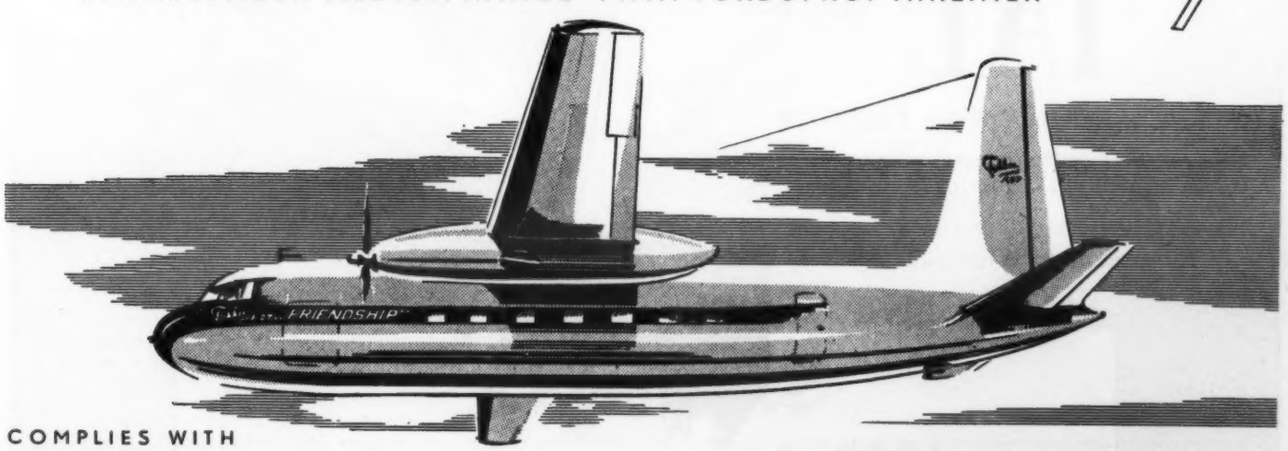

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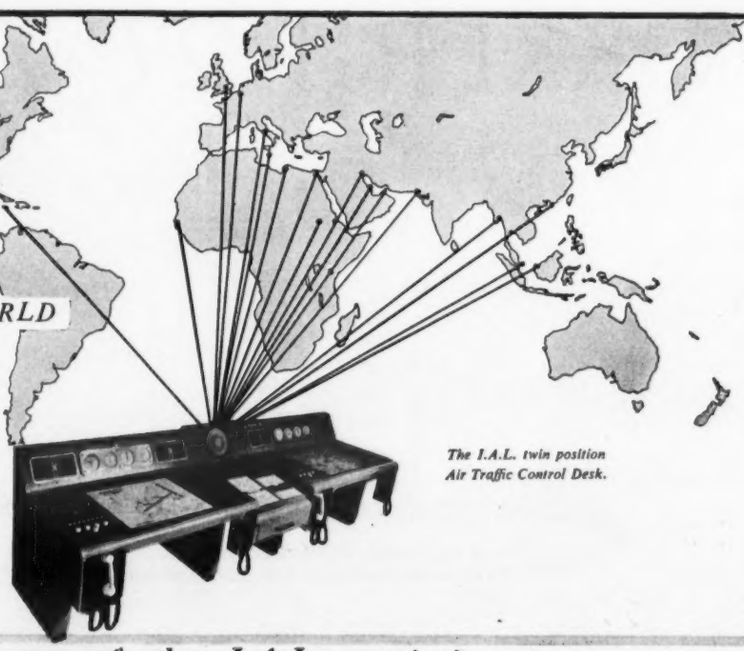

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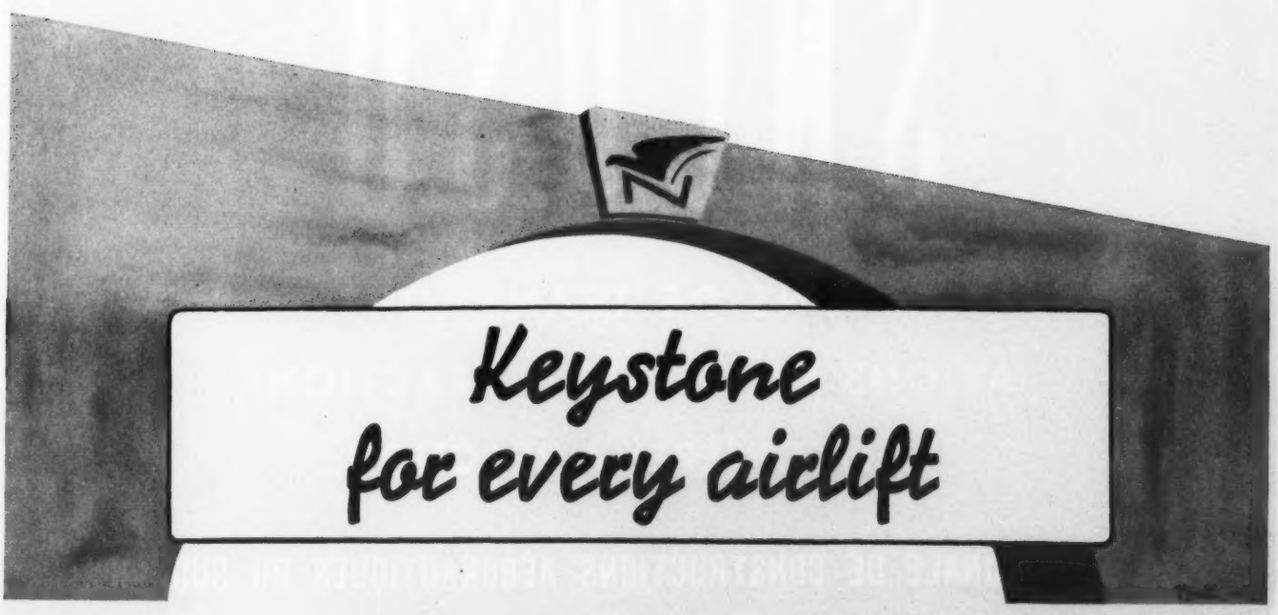

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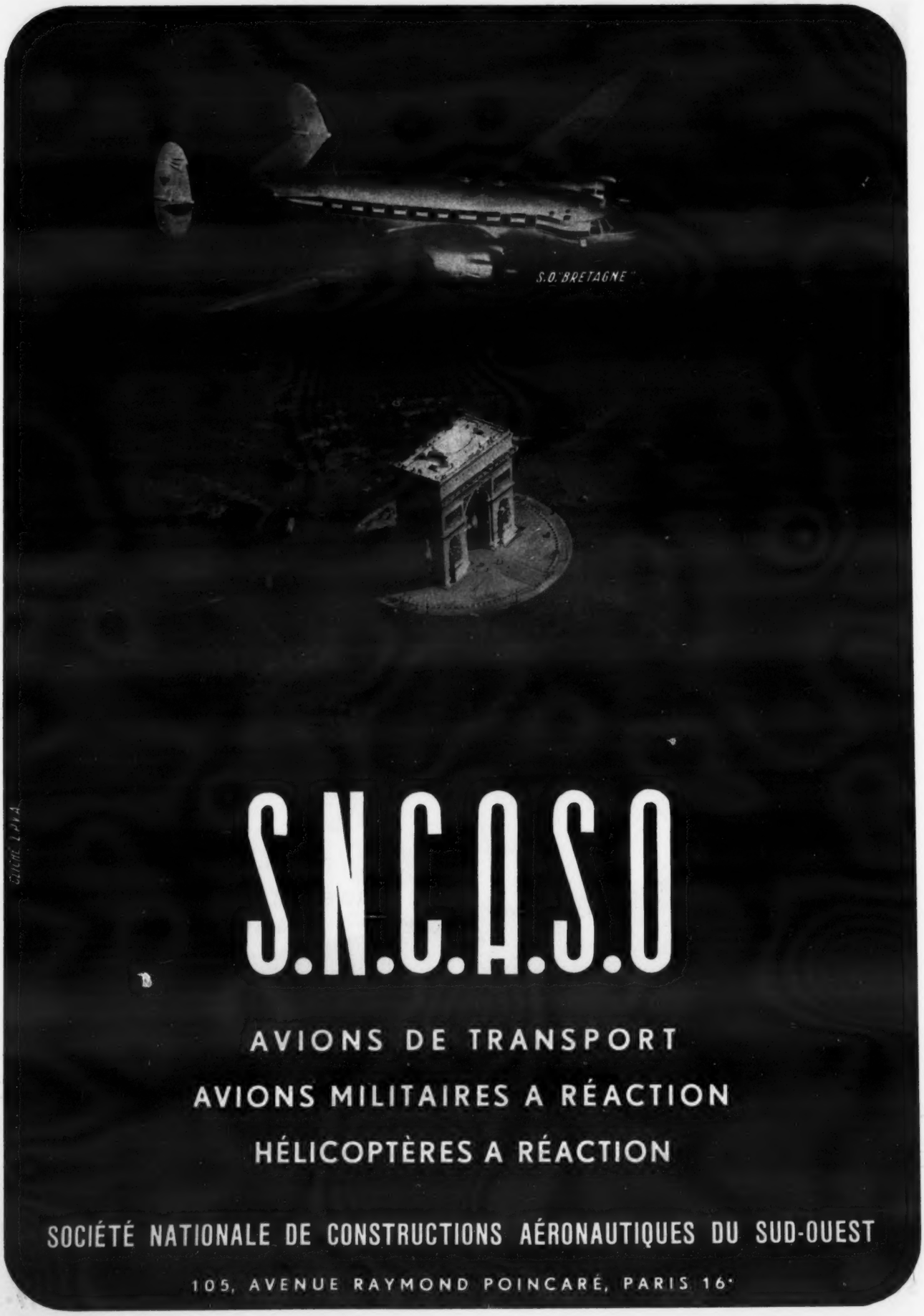

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HÉLICOPTÈRES A RÉACTION

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The game has become almost a cherished tradition . . . Every year our artist comes to me one day in October and asks: "Have you any ideas?"—No, none at all . . . The same scene is repeated the following morning and for several mornings running, our artist gradually assuming an injured air, a kind of gentle scorn for his unimaginative Editor.

Then one day he arrives in triumph and lays his sketch before me with a superior smile. One year it was hands raised to heaven, another a roundabout, and last year a church tower . . . Plus a Christmas tree or at any rate some yew branches.

You have of course guessed ! We are talking about our Christmas greeting, our endeavour to give our readers a few words of encouragement for the new year.

But this year ? Our staff genius's imagination—as you can see for yourselves—has dreamed up a somewhat grandfatherly oil lamp . . . "What is that supposed to mean ?"—Artists are strange people and ours is no exception. We finally gathered from his explanations that it was intended to represent an "aeronautico-politico-artistico-philosophical subject." And it is to me it falls to interpret this allegory . . .

Is this lamp a version of the oil lamp which John D. Rockefeller supplied free to the Chinese to increase oil consumption in China and lay the foundation of the world-wide firm of Standard Oil ? Or was our artist making a gentle allusion to Mr. Mossadegh who recently—and in none too friendly a fashion—decided to light the way home for the Anglo-Iranian Oil Co. ?

To me the glow of this lamp shines out like a hope, in spite of all the alarums and excursions in East and West. To me it is

ALADDIN'S LAMP

In the Arabian Nights, Queen Sheherezade tells the story of a little boy called Aladdin, son of a poor tailor's widow, who comes into possession, through a wicked African magician, of a magic lamp. When he rubs the lamp a genie appears ready to fulfil his slightest wish. And of course Aladdin becomes rich and respected and marries the Sultan's beautiful daughter. His tale plays in far-away China and stretches across to Africa, across East and West, where a different kind of drama is being played out today. And of course—how could it be otherwise ?—it has a happy ending.

Let us take this lamp as a sign of our times, as a symbol of hope. We cannot devote this issue, as we should like, to truly Christmas themes, for we too must talk of West and East. But Aladdin's lamp shines forth ! For all men of good will it still lights the way to a brighter future.

And so we wish you all a Merry Christmas and a Happy New Year !

EDITORS AND PUBLISHERS

Year-End Balance—Accent on Politics

The Background

In normal times the main criteria determining aeronautical development are research, engineering, industry and national economy, and military and civilian requirements. In wartime Mars takes over undivided command. In times of political tension, such as we are living through at the end of 1952, the dominant rôle passes to politics.

This is true first and foremost in the *United States,* where the future aircraft procurement programme will probably depend on the outcome of the Presidential elections. Yet, regardless of who wins, strategic concepts on the other side of the Atlantic remain the same. Within the global strategy to which the United States feels itself committed the atom bomb and strategic bomber programme still takes first place. That the giant Convair B-36 bomber, which until very recently was regarded as capable of deciding any war, should have become obsolescent so quickly and have been replaced by the new "Stratojet" (B-47) or "Stratofortress" (B-52) jet bombers (at a cost of $10,000,000,000 !) is only of incidental importance. Within this political development American efforts at building up a world-wide system of bases for the use of these jet bombers continue, new escort and interceptor fighters and new rocket weapons are being developed, and, last but not least, the development of propeller turbine and jet-powered commercial transports in America—because priority has had to be given to military orders ?—has taken a back seat.

A summary review of the situation in Western Europe shows a tendency in *Great Britain* to take over what may be termed the intellectual leadership in aviation. The first British atomic weapon experiment, early in October, was an unambiguous gesture. But the last Display at Farnborough—where the British showed their "New Look models"—also betrayed the same desire. There were practically no new aircraft weapons to be seen, but rather new engines, new delta fighters and bombers, new jet fighters with supersonic speeds and new turbo-prop commercial transports. All these models were offered to the Western Powers for production under licence. And British civil aviation ? BOAC is making no secret of the fact that, despite PAA and TWA, Air France, KLM or SAS—not to mention the others—it is striving towards a leading position in international air transportation.

When present orders for the Convair B-36 intercontinental bomber have been filled, it is to be replaced (from 1954 on) by the *Boeing B-52 "Stratofortress"* eight-jet bomber. Gross weight 350,000 lbs., maximum speed 620+ m.p.h., range over 6,200 miles.

A brief glance at *Paris* shows that there aviation is even more markedly coloured by politics. The French construction programme, under general Western rearmament, depends more or less—at any rate financially—on relations with the United States. As a substantial percentage of the French defence budget is at present being swallowed up in Indochina, the French industry is looking to Washington for aid in quantity production. If this aid is given in the form of off-shore orders for the North Atlantic Treaty Organization, the aircraft industry may get into full production in 1953.

The situation in *Rome,* the West's Southern centre, is very similar.

And if we regard the matter from the point of view of *Bonn,* the newest of European capitals, we see that here there can be no talk of aviation at the moment, but only of air politics.

We could then point to the East, to Moscow or Peking. However, there is little point in joining in the guessing game, which is more amusing politically than technically reliable. For example, it is alleged in certain quarters that the Russians maintain definite "misinformation" centres in a number of Western cities, to stimulate the imagination of the more gullible Staff officers and journalists. The world knows that Russia is making first-class jet fighters in large numbers, thanks to the indiscretion they have committed in Korea. *But is it equally certain that the Red Air Force also has a strategic bomber fleet of any size ?* At any rate the Russians have never yet threatened to use the atom bomb, at least not officially. In the field of guided missiles, they have probably, thanks to German aid, got as far as the others.

The Crux of the Matter

The facts mentioned below are taken from national sources. For example the French weekly "Match" published an article by Raymond Cartier at the end of October entitled "What France has against America" (Ce que la France reproche aux Américains). Hats off to Cartier and to "Match," to whose permanent staff this king of reporters belongs.

Cartier introduces his remarks with a snapshot of the United Nations General Assembly early in October, the first to be held in the new building in New York. Russia's Foreign Minister Vishinsky was in great form. America, he said, was prolonging the war in Korea to increase the war profits of its billionnaires ; it was threatening the peace of the world, degrading humanity, etc., etc. And—somewhat to the surprise of the uninitiated—there was applause from the public . . . Cartier with typical logic then adds : "Imagine a United Nations Assembly taking place in Moscow and a Western foreign minister getting up and insulting the Soviet régime to the applause of Soviet citizens among the audience ! And that the next day Pravda—as the New York Times did—publishing the text of such a speech in extenso !"

Having thus paid tribute to his country's American ally in his opening paragraph, Cartier goes on to examine the inner causes of the political friction which exists at the end of this year of 1952 between Washington, Paris and Bonn—with Paris as centre.

Acting as mouthpiece for a large number of Frenchmen and of Europeans in general, Cartier lays the blame for the present cold war, for Korea, Indochina, Persia, Egypt and North Africa—to mention only these centres of friction—not on the present American Government, but on American politics of the past ten years.

Up to 1939 America was isolationist. In December 1941 came the United States' entry into the war, the beginning of its rôle as world

leader, its decisive contribution to victory in East and West, and finally the fateful errors of the Roosevelt era. At Yalta and Potsdam the American President favoured Russia above and before all. At Russia's request the Allies' final offensive was made in Western Europe and not—as Churchill advocated—through the Balkans into Eastern Europe. The Russians were tacitly promised Europe as their sphere of influence. At the Cairo meeting Roosevelt more or less made a present of Indochina to the Chinese, and Korea as well. European colonial possessions in the Far East were so to speak sold off. And Cartier stresses particularly that Roosevelt personally advised the Sultan of Morocco to flee to America and thus make himself independent of the French protectorate.

Let us pass over what has happened since 1947. The important point is that there was a complete volte-face by the United States in 1950, with the beginning of the Korean conflict. They now called upon the "liquidated" Europeans, so to speak out of a clear sky, to arm and to form with them a defensive front against Asia. The North Atlantic Treaty Organization was set up, with sixteen member States, and foundations laid for the European Defence Community, in which conquered Germany—which but yesterday was to be completely crushed—was to be an equal partner.

Now, once they have taken a decision, the Americans—unlike the Europeans—are always in great haste to see it put into effect. Except for the War of Independence and the Civil War, the Americans have never known war in their own territory. They are young and fresh. Europeans, although not completely shattered by the wars of the 17th, 18th, 19th and 20th centuries, have not exactly acquired from them an enthusiasm for war. Even the German soldier today prefers his hearth and home to a glorious death on the battlefield. To put it plainly—and this is still Cartier speaking—the Frenchman, like all Europeans, has today realized the necessity for a consolidation of the West, a Western alliance and Western rearmament . . . But he is not anxious to see the continuity of European politics overthrown too often.

By the time these lines appear in print the whole situation may have been clarified with the election of a new President and the formation of a new Government, or it may even perhaps have become catastrophic. Perhaps the Americans will return to isolationism in January 1953. Then they will have no more trouble with Europe and need no longer concern themselves with NATO, or the European Defence Community. What then happened to Europe would be between the Europeans and the Russians. And how the Americans dealt with the Russians would be their affair. Fortunately the West is still presenting a united front. The rearmament of Western Europe and—in particular at America's wish—the rearmament of Western Germany are regarded as vital. That this however is a somewhat thorny problem for Germany's neighbours cannot be denied either in Washington or in Bonn.

The *Boeing B-47 "Stratojet,"* the U.S. Air Force's new medium jet bomber, has reached speeds of 600+ m.p.h.

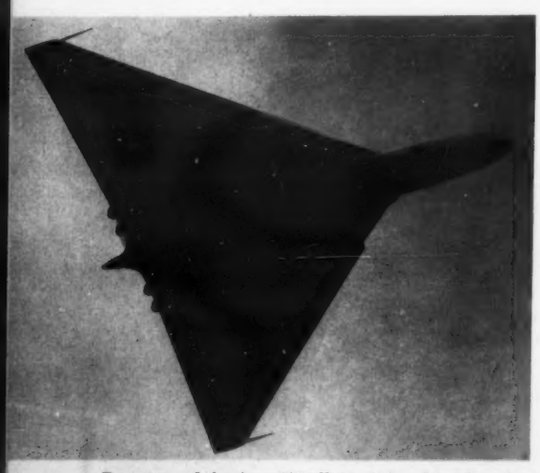
The restoration of German aviation

This brings us to the subject which is most occupying Washington, Paris and Bonn. Let us discard the notion of "armament" as being too general, and concentrate on what is more and more becoming the incarnation of defence sovereignty even in the smallest of small States, namely sovereignty in the air, the right to control national skies, to operate air services on domestic and international routes. And this implies inevitably the right to build the equipment for such operations.

These rights are important to the Germans today, although not even their worst extremists will want to revive Göring's fantasy of a "nation of flyers."

The rearming of Germany or the West German Federal Republic is theoretically today, seven years after the end of the war, no less justified than that of the Balkan States or Japan. The French, fundamentally realists, have already accepted in their hearts German rearmament on land, sea and air. But once more it is the somewhat overhasty manner of the Americans which makes the pill of German rearmament particularly difficult to swallow. If it had been suggested to any German three years ago that by 1952 he could be thinking of armed forces, an air force or an airline, he would probably have thought his interlocutor had taken leave of his senses.

A Northrop F-89D "Scorpion" all-weather fighter firing off a 2.75-inch rocket.



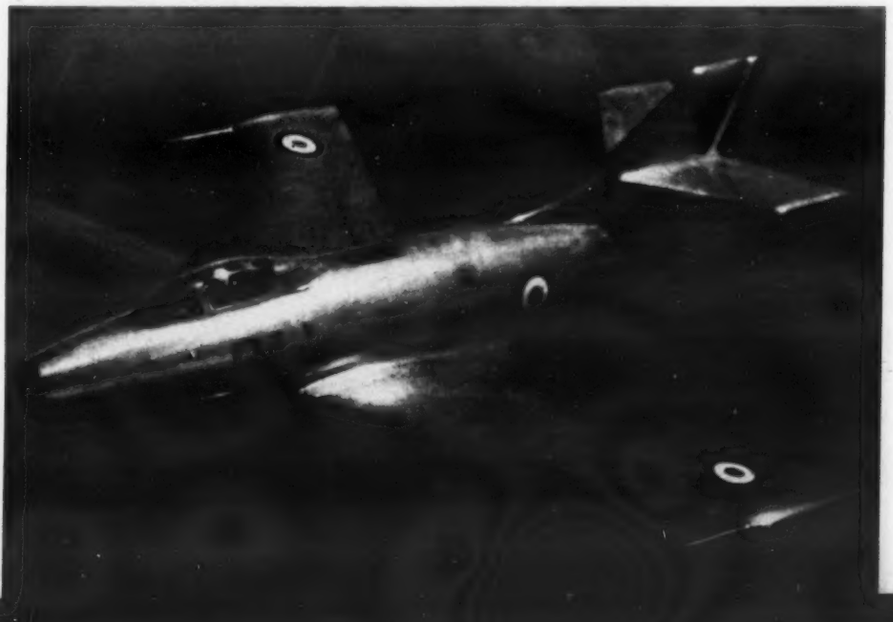
Prototype of the Avro 698 "Vulcan" four-jet delta-wing bomber, which is to be built in quantity for the RAF.

There are also Germans whose task it is to organize—though still only on paper—a new German Air Force within the framework of the European Defence Community. In Bonn there is the Blank Office, the nucleus of a future defence ministry for Western Germany, which has already been permitted to send representatives to the Palais de Chaillot in Paris, headquarters of NATO and the European Defence Community. And both French and British say that these German delegates have been received with sympathy and friendliness. Why therefore should there not be a German air force ? Why should Germany not have sovereignty in the air ?

If the latter is granted, Western Germany would be able to make the following demands, within the framework of the German treaty and the European army :

Formation of a German air transport company, a new Deutsche Lufthansa, which would take over services within West German terri-

The NATO Council recommends that the *Dassault MD 452 "Mystère,"* which has several times reached supersonic speeds this autumn, should be built not only for the French Air Force but also for other NATO countries.



When plans for these developments gradually came under discussion, the Germans—like the French—at first felt themselves taken unawares, suspected a trap and immediately said : "Not me !"—Today ? Some have accepted the situation after mature consideration, others—and not the worst—with some misgivings. Still others see in it a chance for Naziism to raise its head again, and it is these latter that are spoiling the appetites of other Europeans, particularly the French.

tory and from Germany to other parts of Europe from other countries and operate them under the German flag. The development of this Deutsche Lufthansa will not depend only on the equipment which it can obtain from abroad, or on the men who fly and service these aircraft. The new Deutsche Lufthansa, to put it bluntly, will be a competitor to existing companies, and hence much will depend on the tact and sincerity with which the competent men at the Federal Transport Ministry and at the head of the future company cultivate international relations.

If you go to Bonn or Cologne you will see many well-known faces from international air transportation, Americans, British, French, all anxious to cooperate on a purely commercial basis with the future German airline. Although six months ago the provision of capital for an air transport company, particularly in view of the high cost of flying equipment, constituted quite a problem for competent German circles, the situation now appears to have undergone a fundamental change. In Germany there is more or less open discussion of a possible long-term foreign loan from the American Government's Export-Import Bank, which would remove all difficulties. In the light of these developments it is probable that neither British offers of the "Viscount" or the "Comet" nor French offers of the "Bretagne" will interest the Germans nearly as much as the purchase of twin-engined and four-engined types of American make. This is roughly the picture that appears to be forming itself in German minds.

It is three years ago almost to the day that Dr. Albert Plesman, President of KLM and one of the most successful air transport figures of our times, categorically turned down the idea of German air transport. Not for the next twenty years ; the Germans have other things to do ! Today Plesman is riding his hobby horse of international cooperation, and recently called on Federal Chancellor Adenauer.

And the German Transport Minister ? Three years ago he was trying to make foreign contacts and is said to have paid a visit, in vain, to his French colleague, a certain M. Pinay. Today ? At the recent opening of Hornberg Gliding School this successful German politician described a typical example of the change in foreign relations. Two years ago an influential American expressed a desire to see him, but no meeting actually took place. Twelve months ago, the same American again suggested an interview, this time considerably more politely, but again there was no meeting.

The *Fiat G.80 jet fighter trainer*. NATO's Paris committee has recommended the quantity production under the off-shore programme for Italy of a night fighter derived from the Fiat G.80.

But in 1952 the same American came humbly asking for an "audience."—Plans for rebuilding German air transport appear to be blooming, regardless of the fact that the founder meeting of the Deutsche Lufthansa, planned for early October, had to be put off and that the Munich training courses for aircrews have again had to be postponed. If everything else goes well—and ultimately it undoubtedly will—German air transport will become a fact !

—What else could Western Germany demand ? A tactical air force of 1500 aircraft and appropriate number of officers and men, after the signing of the German or European treaty. The men officially responsible for preparing the nucleus of this air force have been carefully sifted. It is repeated again and again with conviction that there is no room in the Blank Office for Nazis, ultra-nationalistic hotheads or armchair strategists. The men who work there are flyers and engineers whose promotion under the Nazi régime left much to be desired. They wear mufti and wear it gladly, and in this respect have already adapted themselves to western methods—no American, British or French officer ever disdains civilian clothes. Also German plans for training, aircraft requirements, equipment, radar, etc. seem to be well advanced.

The mentality of these men of the future German air force can be judged from the words of one of their delegates a few months ago. The man in question was sitting round the table with a number of foreign colleagues. " . . . I should like to draw your attention to a somewhat tricky point. Sooner or later Western Germany will be asked to rearm as a member of the European Defence Community. Present

At the Yalta Conference (Crimea) in February 1945 the Western Allies made concessions to the Russians the effects of which are still being felt today. Left to right (front row) : Churchill, Roosevelt, Stalin ; (back row) : Lord Leathers, Britain's Minister of War Transport ; Anthony Eden ; Edward R. Stettinius Jr., U.S. Secretary of State ; Sir Alexander Cadogan, deputy Foreign Secretary ; Molotov ; W. Averell Harriman, at that time U.S. Ambassador to Moscow.

plans however provide that the major part of the necessary industrial effort will not be made on German soil. If the German public gets the impression that the Germans are considered as living on a European glacis, a forlorn outpost, and this glacis is regarded as being too exposed for the production of any kind of aircraft parts, this is bound to have a bad effect on morale. Would it not be more expedient when demanding moral and financial efforts of the Germans to make them feel at the same time that they are equal members of the European family of nations ? I should humbly like to suggest that the psychological aspects of the industrial problem also be examined, and I am convinced that a correct solution will make for successful collaboration."

—That means a German aircraft industry then ? Why not ? A man who decides to sit down at table with his neighbour and is anxious to be on good terms with him, cannot dictate to him what he shall eat and how much he shall take. Either he does not sit down with him at all, or else he does it properly.

An interesting memorandum has been published by the "Verband zur Förderung der Luftfahrt" (Association for the Promotion of Aviation), successor to the former Reich Association of the German Industry and doubtless precursor of a future "Federal Association of the German Aircraft Industry." This organization had its headquarters in Stuttgart up to August 1952, but has since moved to Düsseldorf, the centre of the German heavy industry. The Association's most important members, or their representatives, have since been guests in London and Paris. Representatives of the American industry have invited them or been to see them in Germany. Responsible heads of the agency are Dr. F. Jastrow and an air force officer from World War I called Kastner. Dr. Jastrow recently published a circular entitled "Why must the German People build up an Aircraft Industry again ?," in which he makes the following points :

1. Germany must engage in aeronautical engineering in order to keep her industrial potential in line with the advance in technical knowledge.

2. It is not enough to engage in aeronautical research; a German aircraft industry must also be built up.

3. The European treaty puts the creation of a German aircraft industry in a new light.

4. There is no branch of industry in Germany which can be built up as easily and with such small investment as the aircraft industry.

5. The resuscitation of an aircraft industry would cost the Federal Government no more than the subsidies it has already granted for the reconstruction of other branches of industry.

NATO's Rome Conference (Eighth meeting of NATO Council) discussed the defence of the Middle East and the creation of a European Army. A meeting of NATO's military committee.

Jastrow then supports his five arguments as follows : during the past two decades the dominant rôle of electrical engineering has been superseded by a period of aeronautical engineering, which in turn has provided a stimulus to many other branches of industry. Without the experience and achievements of aeronautical engineering today's general technical level of production, for example in the automobile industry, could not have been reached. Sheet metal shaping, meteorology, medicine, photo-optics, etc. are all cited to show how stimulating aircraft engineering has been. Jastrow recommends cooperation between the Western countries in the field of research, as these countries' individual resources are inadequate,

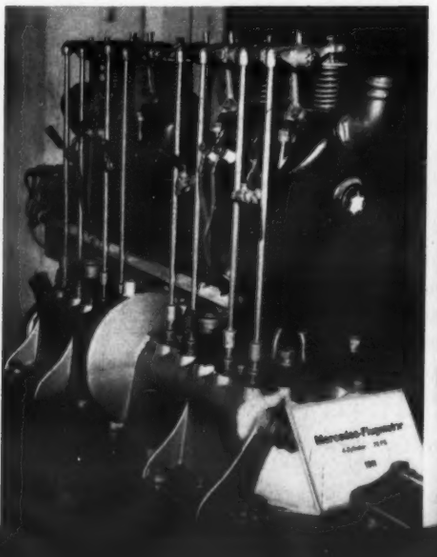
1885—1945 Six Decades of

Gottlieb Daimler, the designer of the first high-speed four-stroke petrol engine, applied for a patent for his particularly light-weight thermal engine as a power plant for aircraft as early as 1885 (DRP No. 36,423 of August 29th, 1885). Three years later Wölfert's dirigible balloon, fitted with a 4 h.p. engine of this type (to drive the pusher and lift screws), started out on its first flight over Bad Cannstadt. The two four-cylinder engines supplied in 1889 for Count Zeppelin's first rigid airship each delivered 12 h.p. Soon the power of Daimler airship engines climbed to 240 h.p., and the last engine of this series, the 16-cylinder DB 602 diesel developed in 1933 for the LZ 129 and LZ 130 commercial airships, had a maximum output of 1200 h.p. at 1600 r.p.m.

Results obtained with aircraft engines were no less striking. The Daimler Works (Stuttgart and Berlin) and the Benz Works (Mannheim), which did not amalgamate until 1926, rivalled each other in providing the rising civil and military aviation with increasingly powerful engines. An air-cooled four-cylinder radial was built by Daimler as far back as 1908. The 70 h.p. Daimler engine of 1911 (Daimler engines already bore the name "Mercedes") was regarded as the best aircraft engine of its time. It had four upright cylinders (with suspended valves and valve rockers) and sleeve valve carburettor with water heating. Carl Benz & Cie. were also not idle and won the 1913 Kaiser-Preis with a 100 h.p. four-cylinder engine. Four years later power had already increased to 500 h.p. (at 1450 r.p.m.), as shown in the picture of the 18-cylinder Mercedes W engine of 1917/1918. This engine, with a stroke volume of 44 litres, already had a triple carburettor with two float chambers and Bosch magneto ignition.

1908 : air-cooled Mercedes radial engine, Schiske patent.

1911 : 70 h.p. water-cooled Mercedes in-line engine.



whereas coordination could produce nothing but good results. He speaks openly of French and British exploratory discussions in this direction. He even considers, somewhat optimistically, that a German aircraft industry can ultimately produce flying equipment more cheaply than that purchased abroad. He calculates that the total business volume of this industry would be almost DM 2,000,000,000 a year and would produce up to DM 600,000,000 in taxation. In spite of war damage there is still sufficient industrial capacity left to rebuild the industry, although the machine tools, especially heavy presses for airframe manufacture, which had been dismantled, would have to be replaced. This would entail expenditure of roughly DM 6000 per man employed, and he envisages an initial overall employment figure of 10,000, which would cost DM 60,000,000. No new investment would be needed for the additional 20,000 workers to keep the aircraft industry supplied, as these industries already exist.

Looked at objectively this budget for the restoration of a German aircraft industry appears to be rather low, but Dr. Jastrow doubtless wished to make his proposal palatable. Even if the cost were five or ten times as high, the effort would still be possible and well worth while. The creation of a new Deutsche Lufthansa will cost at least DM 300,000,000, and this is ultimately scarcely more important to Germany and even to the whole European Defence Community than the industry without which Western European quantity production cannot be rounded off.

German industrialists at Farnborough (second from left Prof. Heinkel ; second from right Fritz Siebel).

Conclusion

The atmosphere prevailing in Washington, Paris and Bonn at the end of 1952 has been amply depicted in the daily press. What we have tried to show here is the effect of this atmosphere on the embryo European Army, on aviation in the West and on German aviation ambitions. The whole question of German aviation would be of very minor significance if it were not, in the opinion of the Americans, British, Italians, Dutch and Belgians, the Scandinavians and even the French in their heart of hearts, of decisive importance to the birth of the European Defence Community and hence to the defence of the West.

It is the task of the Western Allies to give France, as close neighbour to Western Germany, the guarantees which she is entitled to ask after her experiences of the past forty years. And the Germans, for their part, must show enough tact and good will to prove that they know how to make good use of the gifts of fate which have so to speak fallen into their laps as a result of the events of the past two years. If these prerequisites are met in the two most important European partners in this defence community, full cooperation will follow automatically.

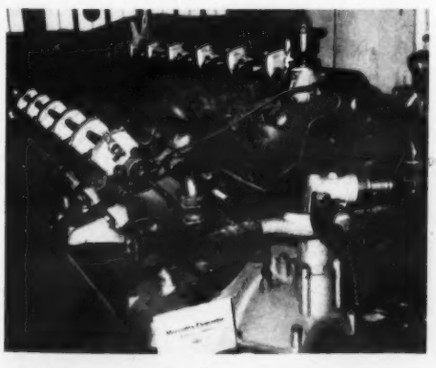
Europe would then be born ! A European Army would be a matter of course and German aviation would make no more stir than the foundation of any other large industry creates today. Once a united Europe exists, all threat from the East and all "tutelage" from the West will one day automatically disappear. Then European genius, European culture and European engineering will have proved once again that they are not empty phrases.

If this goal is not reached, then all words, spoken and written, are vain, including the above. *E. E. H.*

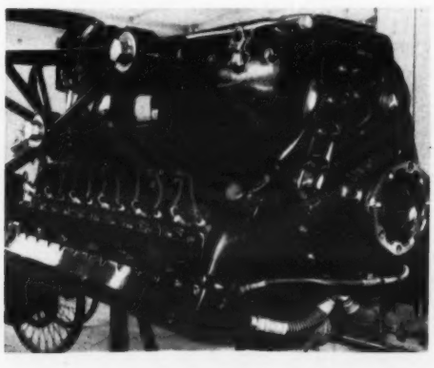
Daimler-Benz Aero Engines

After World War I Daimler-Benz AG had to restrict itself for several years to the production of small engines for sports aircraft. But here too first-class results were achieved, as was proved by Freiherr von König-Warthausen's world flight with a 20 h.p. air-cooled engine in 1929. It was not until 1928 that development of more powerful aircraft engines began, and Daimler-Benz's new 1050 h.p. DB 600 high-performance engine was not shown to the international public until the Zurich Air Meeting in 1937. The following year this engine was developed into the DB 601 by introducing direct fuel injection into the cylinders. It was with this engine fitted on a Messerschmitt Bf 109 R that Flight Captain Wendel set up the still unbeaten international speed record for piston-engined landplanes (755.138 km/h) on April 26th, 1939. Officially the power of Wendel's engine was only 1050 h.p. (at 2400 r.p.m.), but it appears to have been boosted to deliver some 1800 h.p. (at approx. 3500 r.p.m.). — The DB 601 then became the Luftwaffe's most important engine in World War II. Most single-engined (Me 109s) and twin-engined fighters (Me 110s) were fitted with it. Later developments led to the DB 603 (approx. 1800 h.p.) and DB 605 (1500-2000 h.p.), and to the DB 606 (two DB 601s), DB 610 (two DB 605s) and DB 613 (two DB 603s) coupled engines. A 24-cylinder four-row engine, the DB 604 (2700 h.p.), and a twelve-cylinder diesel engine, the DB 607 (1750 h.p.), were also produced. Pictures (from the Mercedes-Benz Museum, Stuttgart-Untertürkheim) show four essential phases in these six decades of aircraft engine development.

1917 : 500 h.p. water-cooled Mercedes three-row engine, also known as "porcupine" because of its 18 cylinders.



1938 : DB 601 liquid cooled twelve-cylinder injection engine of 1000+ h.p., with supercharger and reduction gear.



Lessons of the War in Indochina

BY GENERAL G. J. M. CHASSIN,

AIR OFFICER COMMANDING, FAR EAST

The French war in Indochina is not a Colonial war in the traditional sense of the word, and there are many voices in France who, regardless of the risk of heavy economic losses, demand withdrawal from this theatre of war. It should not be overlooked that France no longer has a colonial empire, since all French possessions overseas were grouped together after World War II into the French Union (French counterpart of the British Commonwealth) and representatives of all countries and races sit in the French Parliament.

The position in Indochina is the same as in Korea, except that, for reasons this is not the place to discuss, the Indochina theatre has not aroused the same world interest as the United Nations operations on the Yalu River. In Indochina too it is basically a struggle between West and East; it is another "hot episode in the cold war."

How closely on the other hand this drain on French lives and resources is connected with world politics became apparent on October 17th, 1952, when at the annual congress of the powerful Radical Socialist party in Bordeaux former Prime Minister Daladier categorically demanded a withdrawal from Indochina! A withdrawal from Indochina to consolidate French interests in Europe and Africa! And without such withdrawal France should neither agree to nor participate in the European Defence Community. It was in the same month, on October 12th, that French troops made an advance southwest of the Indochinese capital of Hanoi, but were repelled. Two days later there came the long-prepared counter-offensive by the Vietminh—the "North Indochinese"—which at the time of writing is threatening the French positions.

If the French withdraw from Indochina, this will affect not only the French economy. It can and will inevitably have repercussions on the whole of the Far East, on Korea and Malaya, perhaps on Hongkong too. Once again the white man is in danger of losing face.

As already stated, the Western world has so far tended, for reasons that are not always clear, to overlook Indochina. There will therefore doubtless be many readers who will welcome an unvarnished account of the air war in Indochina and the lessons that can be learned from it. *The account comes from the pen of* General Guillaume Jean Max Chassin, Commander-in-Chief of the French Air Force in Indochina. *General Chassin, who is now 50, studied mathematics and political science, and began his service career in the Navy. In 1928 he learned to fly and transferred to the Air Force, and in 1936, after a period with the Air Staff, he served as paratroop officer. Since then he has held a variety of high Staff posts both in France and overseas. In July 1951 he was appointed to command the Air Force in Indochina.*

An experienced, respected and cultured officer warns that the cold war in Europe may one day produce local hot episodes of the kind now being played out in Korea and Indochina . . .

THE EDITORS

At first sight it may seem pointless to try and draw air warfare lessons from the fighting in Indochina. Up to the present not a single Communist aircraft has appeared in the sky, where the French forces have complete mastery. What can be learned from an air war without an adversary?

A great deal for, strange as it may seem, the war in Indochina, far from being just another of the now-familiar colonial wars, provides us with a foretaste of wars to come. And above all it demonstrates once again the application of the eternal laws which govern the drama of war. The first of these laws is:

When offensive weapons make a sudden advance in efficiency, the reaction of the side which has none is to disperse, to thin out, to fall back on medieval guerrilla tactics which would appear childish if they did not rapidly prove to have excellent results.

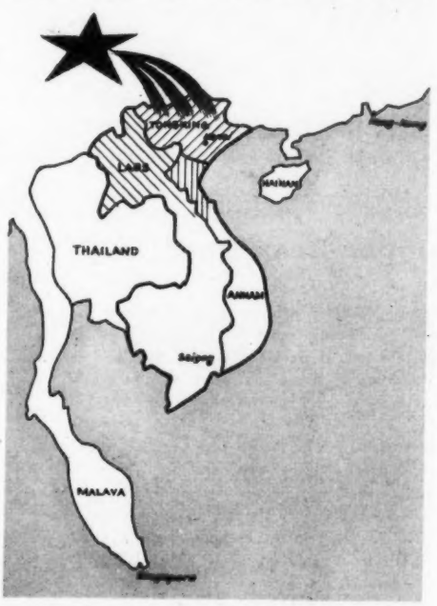
The second law is equally important, though less well-known:

When uncontrolled evolution, pushed to extremities by technicians working in blinkers, produces "modern" weapons which are of more harm than use, when the exaggerated cult of mobility leads to immobility and the search for absolute protection to vulnerability, older methods reappear as if by a natural reflex action. Thus in Korea the infantryman is far superior to the most up-to-date vehicles, and the ordinary fox-hole is better than any form of armour. The advent of the larger-than-life-size—and its failure—have had the effect of bringing things back on to the "human scale."

Nature of the conflict

The war in Indochina presents the spectacle of a Franco-Vietnam army of Western type, well armed and mechanized, with considerable superiority in artillery and complete supremacy in air and naval forces, fighting a smaller army, less well-armed, but fanatical and favoured

Map of the Far East, showing the three provinces in which the Franco-Vietnam forces are fighting the Communist Vietminh forces: Tonkin, Laos and Annam. Right, the island of Hainan from which Communist motor boats make night raids on the Annamese coast.



Napalm canisters being dropped on Vietminh straw huts by Junkers Ju 52's. This type-of operation is particularly difficult to accomplish successfully in the Indochinese jungle.

with the support of a large part of the population, since this war is in essence a civil war. The Vietminh army, following the Communist method made famous by Mao Tse-tung, adopted from the outset the type of warfare which denies the enemy his chief advantages ; namely, generalized guerrilla tactics, establishment of "bases" in enemy-held territory, raids on communications, sporadic attacks by numerically greatly superior forces. These are to be continued until the moment arrives when—it hopes—it has sufficiently weakened its adversary and, having meanwhile built up and trained its own units, can launch a general counter-offensive, with aid received from abroad, to end the struggle.

The plan is extremely clear-cut and its execution easy to follow. The first unorganized troops were followed by battalions, regiments and finally divisions. Schools were opened. Officers and NCOs were trained and are now very valuable. Tonkin, the principal front, has five Vietminh divisions encamped around the delta, while the interior of this sacred triangle is constantly subjected to attempts at "corruption," with continual infiltrations and establishment of "bases" which have reached the strength of 30 battalions in our rear. Annam is at the regiment stage, South Vietnam at the battalion : guerrilla warfare here reigns supreme.

On the other side, the Franco-Vietnam army, like Chiang Kai-shek's Nationalist Army, suffers from the considerable disadvantage attaching to those who seek to protect and preserve rather than simply destroy. It is much easier to cut a railway line or blow up a bridge than to protect them from destruction. The result is that the "protective" army must employ a large part of its resources on static defence, which frequently fails in its objects, whilst the "destructive" army can keep all its forces mobile, concentrating them as and where it chooses. Again, the Vietminh army, which has a large part of the population under its domination, does not need to provide military occupation for the territories it controls. It advances along a *line,* whereas the Franco-Vietnam army cannot afford to leave anything unprotected behind it. It must occupy the whole *area,* establish itself wherever it goes by creating a multitude of defence posts capable of providing some kind of protection within a limited radius. This entails a considerable expenditure of forces and is a terrible handicap in the conduct of the war.

This is the type of warfare, unfortunately too little known, which determines the peculiarities of air operations in Indochina. These peculiarities are found in all the classic domains : command, organization, personnel, equipment, logistics, tactics and strategy.

The lessons that can be learned are of two general kinds. Some are mere confirmations of past experience, positive or negative ; there is no need to go into these here. But there are also new ones, of the greatest importance since they are concerned with the very form of air warfare and with its future possibilities.

A "glass-nose" Douglas B-26 "Invader." These aircraft have Norden bomb-sights and act as pathfinders. B-26 "strafers" have eight heavy machine guns instead of the sight. Their fire power is formidable.

Command

Both successes and failures in the Indochina war have shown that, to be successful, the higher command must be integrated and must fully coordinate all operations on land, sea and air.

A modern commander-in-chief must have a combined staff on which all three arms are equally represented and prepare the general conduct of the war. Pure land operations are today quite out of the question. The air forces always play a *preponderant* part, and it can be said that here, in the majority of cases, it is they who swing the balance in our favour. The conditions of employment of the air arm must therefore be considered first and foremost, and ground operations tailored to fit. To plan an operation solely on land and then add willy-nilly either close or long-range air support, is the best method of piling up failures, as we have seen.

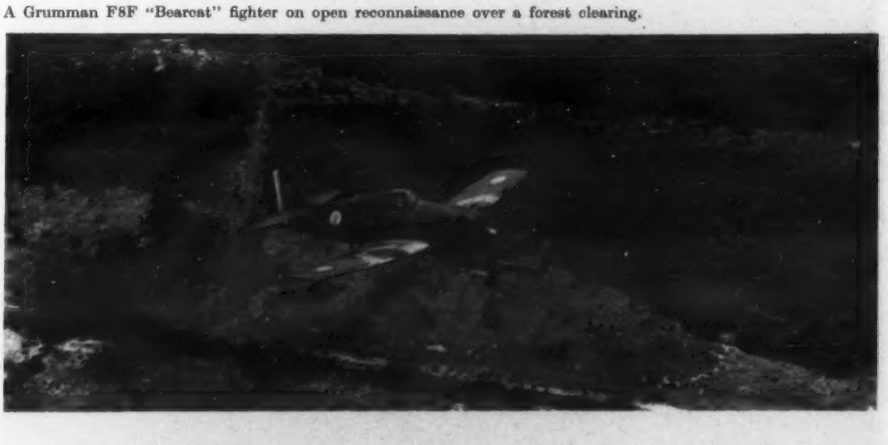
The commanders of the ground forces have realized that the air forces cannot come direct under their orders, as for instance the artillery does. The procedure is clear-cut : "ground" asks "air" for *missions,* leaving the latter full liberty to accept or refuse, and to decide on the technical means required. Ground staffs no longer demand "eight B-26's loaded with 500-lb. delay action bombs" or "nine fighters with napalm," as they used to do, thereby evidencing a highly regrettable confusion in competencies. Close liaison is essential, and mutual understanding, on the friendliest possible terms, is the only hope of success. Each partner must stick to his own field, and the air command must also refrain from demanding special manoeuvres by the mortars, guns and battalions defending its bases. It must be content with asking the land command to provide its defence, leaving it in turn free to decide on ways and means.

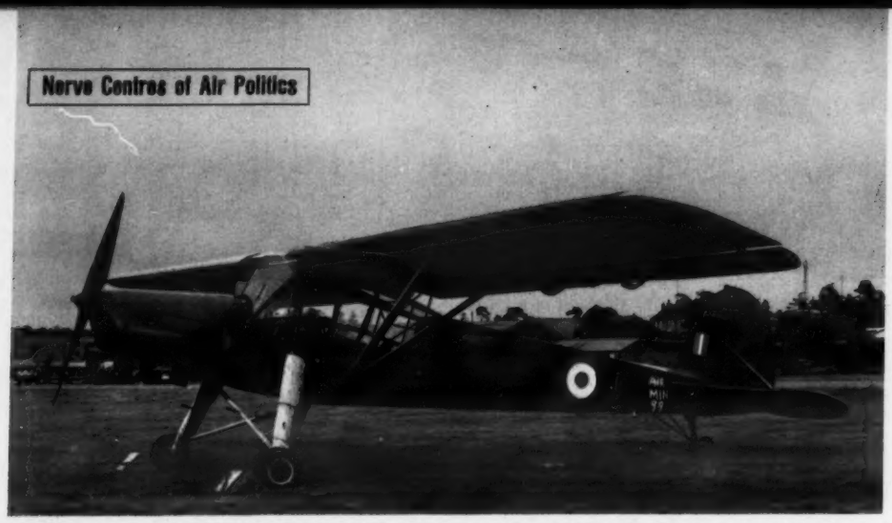
The French theory of the employment of air forces is well known. It insists on the interdependence and equality of all three defence forces, with no one of them being considered as the auxiliary to the other two. Like the Anglo-Saxon doctrine, it gives top priority to the conquest of aerial superiority, with destruction of the enemy's war potential in second place and support for the surface only in third place.

The weakness of the air forces in Indochina however has necessitated modifications to the pure theory. There are no forces specially reserved for destruction of the enemy's war potential, and multi-purpose aircraft such as the B-26 "Invader" are used successively for close support of the ground troops and for indirect action, e.g. containing the battle-field (cutting lines of communication), economic warfare (attacks on furnaces or irrigation systems), raids on armament factories or nerve centres of the enemy command, etc.

As a general rule priority is given to direct support, and long-distance operations are only undertaken, with the consent of the inter-service command, when such priority can be given. Although the top command is fully aware of the importance of long-range operations, which have produced some extremely valuable results, in particular since the be-

A Grumman F8F "Bearcat" fighter on open reconnaissance over a forest clearing.





The Morane 500 "Criquet" lends itself admirably to air reconnaissance. This is the French version of the German Fieseler "Storch," but differs from the latter in the absence of wind-screen streamlining.

ginning of 1952, there are still some local commands which are always apprehensive of possible attacks and are often unenthusiastic when they see fighters and bombers set off on strategic missions, whose success may nevertheless be of the utmost value to them. It is obvious that cutting the Vietminh's supplies of arms and ammunition from China is of greater effect on subsequent operations than an attack on a fortified village in the delta.

The existence side-by-side of the independent air command and the ground command to which it is "attached," under the aegis of the interservice commander-in-chief, therefore demands of the land forces a high degree of understanding, which incidentally has never been lacking here. The air command cannot agree without protest to equipment as costly and scarce as the aircraft being used for missions which can be accomplished equally well by less costly arms, such as the artillery. It is difficult to make those who are not directly accountable for them understand the "cost" of air forces.

The same applies to logistic requirements. The wounded can be encouraged to make a supreme effort, and exhausted men galvanised into action. But a broken-down aircraft cannot be galvanised, and not even the most eloquent of speeches can make an engine run when it has no fuel. Engine and airframe inspections are inescapable necessities and all machines have to be sent back to the rear for detailed overhaul after a certain number of flying hours. Thus the number of machines available at any given time, especially in a distant theatre of operations where climatic conditions are as hostile as in Indochina, is rarely higher than 70% of the total. The combined staffs must allow for this limitation in their planning ; it is the price of technical progress.

Vietnam parachutists boarding a Douglas C-47 "Dakota." The ability to carry out rapid "vertical enveloping movements" has been the chief contributing cause of Franco-Vietnam successes.

Finally, ground commanders who have fought in Indochina should not come back with false ideas. It is obvious that if an enemy air force one day appeared in the Tonkin skies air defence would go back to first place in importance and support missions would immediately be reduced by 70 to 80%. The ground forces, which have become accustomed to fighting only with powerful air support, must realise that the present situation is quite exceptional. Similarly the air forces must not imagine that they will always have the sky entirely to themselves, with the only danger coming from the relatively feeble anti-aircraft defences.

The French Army must avoid the intellectual errors which in 1870 largely resulted from the wars in Algeria and in 1940 from those in Syria and Morocco. At least the relative weakness of our air forces in the Far East will have proved beyond argument to all, that the whole tactical air force must remain under a single command and that to distribute it in small batches among the ground units, as was done in 1940, is the surest way of reducing its efficiency to zero.

The light tactical aircraft

In the tactical field the chief characteristic of the war in Indochina is the invisibility of the enemy, who moves and attacks only at night, and marches in small groups, joining up only for the final assault. Here there are no columns on the march, no lines of sharp-shooters more or less well camouflaged, no convoys of vehicles advancing in single file along the roads. Once outside the controlled zone, there is not a soul to be seen in the fields. When an aircraft flies over a village, the latter empties itself completely, even the domestic animals taking cover. It needs an unusual degree of skill and experience to detect the presence of Vietminh troops in the mountains and forests, where they live under perfect camouflage. There are fox-holes forty to sixty inches in diameter and forty-five to sixty-five inches deep, covered with leaves and grass, all along the roads and even in the rice fields. In the villages themselves the Vietminhs hide in muddy tunnels several miles long, which sometimes join up several villages. It is only the trenches and defence works, however well camouflaged they may be, which enable us to detect the villages where they are installed in force.

It will therefore be seen that "western" methods of operation are useless here. The only aircraft that can see anything clearly is the small slow machine such as the Morane 500 "Criquet." [1] Needless to say main roads are reconnoitred by fast photo-reconnaissance aircraft of the Grumman F8F "Bearcat" type,

[1] French name for the German Fieseler "Storch," whose performance is well known.

and doubtful areas are constantly photographed by heavier aircraft operating at high altitude. This enables a check to be kept on the work being done by the enemy : bridges rebuilt, road detours at river crossings with construction of rafts, railway repairs, locomotive sheds, stores, charcoal furnaces, small factories with chimneys camouflaged as trees, etc . . .

But to see the actual men slow aircraft are required that can "lift up the leaves on the trees and look underneath." Even during the most important operations it is rare that the fighter or bomber pilot can see a single enemy. As for the man fighting on the ground, he is generally unable to give reliable instructions to the aircraft. When he sees the enemy he is already in the thick of the fighting.

The small, slow observation aircraft, the "midge," has thus become the cornerstone of the war in the air, in Indochina as in Korea, and as in Europe tomorrow. The high-speed aircraft will have to be led by it, as the lame man is led by the blind. This is one of the first great lessons of this war. The "midge" works as follows : Communicating simultaneously with ground and air, the pilot flies over the battle-field at low altitude, searching out the slightest signs of the enemy's presence. As soon as he sees a suspicious movement he reports it to the command, and initiates artillery fire which he controls, assault missions which he guides and bombing which he corrects. The fighter pilot bombing or strafing the corner of a wood where he can see nothing obeys him blindly and may find himself congratulated for having scored a hit without ever seeing his target. The bombardier can aim confidently at the straw hut indicated : only the Morane knows that there are Viets inside. When he has finished his mission the "Criquet" comes back and lands on any airstrip and relates everything he has seen to the air and ground chiefs, while the comrade who has relieved him continues his vital work of observation and artillery spotting.

The "western" objection is of course vulnerability. It may be that the "midge" needs protection by special fighter units for this purpose. But the moment the enemy fires he automatically reveals his presence, and this fact—at any rate here—is probably the best protection the small machine can have. Also it should be possible to design equipment which, while retaining the Morane's principal qualities, would be even more suitable for its important task. The Morane sees, but does not itself attack and can only call up the attackers. However quickly the latter may arrive on the scene, the advantage of surprise is frequently lost, and the Vietminhs have already decamped whenever they can.

We should therefore work on a light tactical two-seater, with a maximum speed of not more than 240 m.p.h. and a minimum speed round

Loading containers on a Junkers Ju 52. For several years all posts in Upper Tonkin and Upper Laos have been supplied entirely by air, both with food and with ammunition.

about 50 m.p.h. Its weight, in the region of a ton, will enable it to use any kind of airstrip of some 400 yards in length. The machine should be armed with two machine guns, carry a few rockets, an ultra-light VHF set and if possible be armoured underneath to protect pilot and observer from light weapons. The French "Cyclope," built by Fouga-Mauboussin and fitted with a small Turboméca turbojet, might have been regarded as a basic model for such an aircraft.[2] The Americans now propose to flood the whole of South-east Asia with their FD-25 "Defenders"[3] built in quantity in Japan. In any case the light tactical aircraft is destined to become the cornerstone of the support air forces. Without it, the latter would be blind and therefore helpless. The Army desperately needs equipment of this kind. It has clearly recognized this, and it would be a pity if the air force were lacking in imagination in this direction.

If war follows certain eternal laws, its form nevertheless is in constant evolution. When tactical atom weapons are used, dispersal, self-effacement, camouflage, infiltration, night sorties will become the rule. It would be wrong to expect a future war to resemble that of 1939-1945. This would be the surest way to lose it.

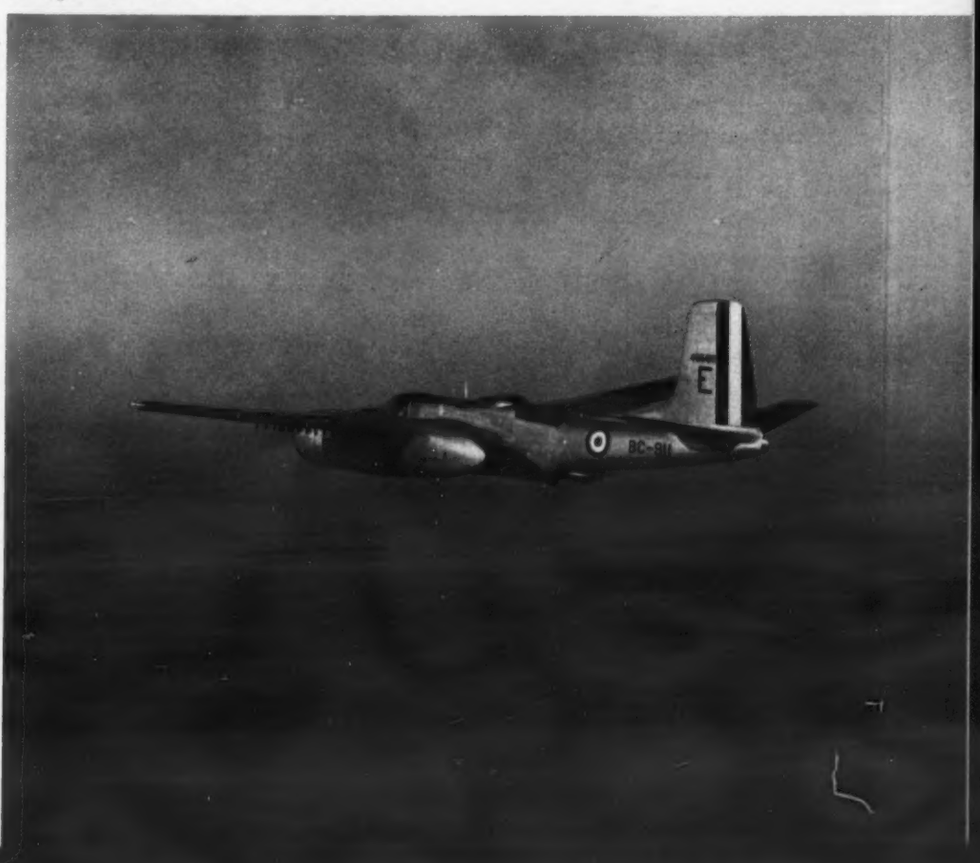
Night operations

The possibility of night operations (and of course operations in bad weather) must be borne constantly in mind by all those responsible for modern air forces. This is a second lesson of the war in Indochina, and perhaps the most important. The Vietminh can continue their desperate resistance, which has already been going on for years, because they know that from sunset to dawn they are

[2] The "Cyclope II," mid-wing cantilever monoplane, powered by a Turboméca "Palas" 350-lb. thrust turbojet, had the following performance for a gross weight of 1275 lbs. : maximum dive speed 280 m.p.h., speed at 13,120 ft. 217 m.p.h., ceiling 29,530 ft., range 186 miles, take-off to clear 65 ft. 980 ft., landing run 720 ft. With a more powerful turbojet and a gross weight of one ton, such a machine could easily take the armament and the small VHF set which would make of it the first and most modern of light tactical aircraft.

[3] Official figures for the FD-25 "Defender's" performance for a gross weight of 2500 lbs. and a 225 h.p. Continental engine are as follows : maximum speed, 187 m.p.h., take-off to clear 50 ft., 1000 ft. ; landing run, 750 ft., endurance 4 hours. The low-wing monoplane two-seater is equipped with two light machine guns in the wings and an ultra light Lear VHF set, and can carry two 40-gallon napalm tanks, two 250-lb. H.E. or fragmentation bombs, forty 2.75-inch rockets or four 5-inch HVAR rockets, depending on the mission to be accomplished. The price of the production model would probably be about $20,000.

A Douglas B-26 "Invader" over the Tonkin delta.



practically untroubled. Villagers can go into the fields, troops march, whole armies of coolies move along the roads, carrying their meagre supplies, sampans sail along the canals. The few trucks which come from China can travel down Colonial road No. 3 with their lights out, fast motor boats leave Hainan for the coast of Annam. The air forces' inability to operate after dark makes the night into a realm of safety for the enemy, who takes feverish advantage of it.

True, the air force is not entirely powerless. It successfully attacks deltas and canals, and for the past year night operations in Cochinchina have brought us some remarkable results. But its efficiency is very greatly reduced in the forests and mountainous regions of Upper Tonkin—just as it is in the mountains of Korea.

As long as the air force cannot intervene at night with the same efficiency as during the day, it will never be the decisive weapon it should be. For that, it must be able to navigate in safety and crews must be able to *see*. The first problem has been almost solved, but the second is far from being so. Here it is not a question of bombing blindly by radar such built-up areas as Essen or Warnemünde. The teeming Vietminhs on the paths beneath the trees really have to be "seen," and this, we have already pointed out, is extremely difficult even by day. The solution will probably be found in the infra-red domain. In any case this quest is of vital importance to the future of the air force, and it is somewhat surprising, in view of the first results obtained during World War II, that the problem has not yet been solved.

Bombing a Vietminh factory on a Cochinchina canal.

Defence of air bases

From the territorial point of view, the situation in Indochina is quite different from that in any western wars, where there is a front separating territories administered and controlled by each of the combattants. It is much more reminiscent of the religious wars, when Catholic and Protestant towns in the same province, sometimes only a few leagues apart, tore each other to pieces.

Although there are areas entirely controlled by the Vietminh, it can scarcely be said that there are regions entirely controlled by the Franco-Vietnams, since even inside large towns the rebels have terrorist action committees and frequently extort contributions from demoralized businessmen. Outside the mountain plateaux, where the Moïs are the born enemies of the Annamite, whoever he is, there is almost everywhere danger of guerrilla attacks. This is why the defence of the air bases presents one of the most important and the most difficult problems of this extraordinary war. It can even be said that the Indochina war proves clearly that this defence must be mission No. 1 for the ground forces, which should not hesitate to devote to it all the personnel and equipment necessary.

Very often air power is not only the factor which tips the balance of ground combat in our favour, but also the only truly offensive arm which enables us to wear down the enemy's potential, attack his sources of supply, harry his units at rest or in training. And since the air force, as a technical arm, cannot live without a powerful ground organization, workshops, stores, runways and extensive quarters, it is easy to imagine the catastrophe which would result from the destruction of an air base.

Airfield defence must be both static and dynamic. It requires blockhouses continuously occupied, day and night, by personnel always on the alert, a continuous belt with powerful lighting patrolled by sentries with highly-trained police dogs, and the collaboration of Army units stationed further away and capable of repelling coordinated attacks by the enemy.

The countless villages which surround the airfields in this overpopulated country are a constant danger since, if they are not closely watched, they can serve as relays for groups of "suicide volunteers" capable of sabotaging and destroying extremely valuable equipment in a single night. The air forces have had to form commandos of hand-picked natives at each of their bases, and these have proved to be the best safeguard.

It is easy to understand the Army's lack of enthusiasm when it sees sizeable units thus immobilized outside the combat zone. But the game is well worth the candle, and the airborne menace, which is absent in Indochina but is so urgent in Europe, still further stresses the imperative need to defend air bases at all costs in any war of the future.

Transport air units

In the transport domain the lessons are merely confirmations of what was already known, but they are nevertheless decisive. The biggest successes we have obtained are the direct result of mass parachute drops made at the opportune moment. Air transport has also been one of the essential conditions of our strategic manoeuvres. It alone enables us to mass at threatened points and, by bringing up unexpected battalions rapidly from the other end of the country, to foil Vietminh attacks by restoring the balance of forces. The Nghialo affair of September 1951 clearly illustrates this principle. Nghialo, a post situated in the zone northwest of Tonkin, completely separated from the delta and having communications with the latter only by air, was attacked by a whole Vietminh division. The dropping of a reinforcing battalion and then of a second in

the rear of an enemy regiment enabled General Salan to achieve a resounding success, the Vietminh division being forced to withdraw in disorder, pursued by assault aircraft which inflicted heavy losses.

The battalions were later withdrawn again by air. As operational airstrips cannot be modern fields with concrete runways, we should point out here how necessary it is for the transport units to have not only high-capacity aircraft of the Fairchild C-119 "Packet" type, but also a low-tonnage machine, simple and light in construction, capable of landing on any airfield.

This is a lesson which should not be forgotten. There are still airfields here where the Douglas C-47 "Dakota" cannot land, and the old Junkers Ju 52 still renders inestimable services. It alone can maintain communications with the numerous posts in Upper Laos and Northwest Tonkin, completely cut off for years from the free zone, and bring up supplies and replacements.

The prototype of the Fletcher FD-25 "Defender," which is to be built under licence in Japan.

Ground organization and equipment

Having no adversaries in the air, the air force in Indochina does not seek high performance, and if it has constructed a magnificent ground organization, capable of handling the most modern aircraft, this is because it must be ready to counter any possible threat. Moreover this ground organization, paid for from military funds, will be ready to deal with the SE 2010 "Armagnacs" and de Havilland "Comets" which will come and call here once peace returns.

As the theatre of operations is relatively narrow, there are no heavy strategic bombers here. The essential combat aircraft are the piston-engined fighter and the light bomber. The methods of attack used are the classic ones.

The piston-engined fighters in service in Indochina are carrier-borne types : the Grumman F6F "Hellcat" and the Grumman F8F "Bearcat." These are remarkably well suited to the theatre, as they are robust, very manoeuvrable, easy to maintain and can operate from short fields. The light bombers are Douglas B-26 "Invaders," heavily armed, which can be used instead of the fighters on relatively long missions. The multi-purpose qualities of the B-26 make it particularly appreciated here.

Other highly valued machines are the Hiller and Sikorsky helicopters which have rescued numbers of wounded and of pilots who had crashed in Vietminh territory.

Much could be said on our supply difficulties. An examination of them would lead to the classic remarks on supplying theatres of war at great distance from the home factories and on the eternal problems of command in a coalition.

But the lesson provided by Indochina on the twin subject of equipment and ground organization is a more profound one. This is to decide whether, in the aviation domain, as in that of tanks and warships, man has not already gone beyond the optimum dimensions in his creations and whether we are not rushing at top speed towards an exaggeration of size and complexity which is always fatal—because it is a sure sign of degeneration.

When we see fighters weighing fourteen tons and bombers weighing a hundred and sixty, which cost fabulous sums and need concrete runways over 3,000 yards long to land on, we are inevitably reminded of the Zeppelin which could be moored at only four places in the whole world. This was its death.

The war in Indochina brings things back to the human level, the simple and the relatively cheap. It requires aircraft capable of using earth runways built at speed by thousands of coolies. It needs hundreds of small robust aircraft suited to their special tasks, which will free us from the gnawing canker of runways getting longer and longer, hence more and more costly and, probably, more and more difficult to defend.

The idea in the air. The American magazine "Aviation Week" recently published an editorial entitled "Complexity, the Frankenstein." The continued advance towards complexity at the furious pace of the past ten years, the author writes, is beginning to appal our best thinkers. And he adds : "Our aircraft designers definitely are thinking in terms of lighter, more simplified planes for the future ... Future designs call for lighter bombers, as well as fighters." Quoting E. E. Heinemann, Chief Engineer of Douglas' El Segundo division (after all, he says, it is only by the final result that the real success of an aircraft can be judged), the author concludes thus : "The obstacles to any simplification may seem insurmountable, and the reasons for more complexity are many and powerful. But if we permit this Frankenstein of complexity to continue work at its current plodding, insidious rate, it will slowly overwhelm us to impotency."

Not slowly, but rapidly, and without the slightest utility. We have the confirmation here in Indochina. Because the truth, the infallible criterion is : the ultimate result is all that counts. The task is to inflict the greatest possible damage on the enemy by the cheapest possible means. If we compare what the death of a Franco-Vietnam soldier costs the Vietminh with the cost to us of a Vietminh death, we can easily understand why this war drags on eternally, and must seriously ask ourselves whether the Western world is really on the right track.

Conclusion

No full examination can be made in a few pages of the lessons to be drawn from this grim and distressing civil war, over 8000 miles from France, where Vietnams stiffened by French and aided by the United States are fighting against the Vietminh supported by the Chinese and aided by the Soviet Union.

However it should be understood that here, as in Korea, we have the model of a future war, which bears no resemblance to what has earlier been imagined. Aviation is confronted by a dilemma—it must either return to a human scale or have recourse to robots. If it wishes to survive in its present form it must get rid of the demons of size and complexity. If it wishes to continue in an evolution which seems to many to be inescapable it must break loose completely from the human crew and leave it behind on the ground. But if in the present shadows we seek to discern the outlines of the future, how shall we not be appalled by the intensive employment of robots ? Would not their victory mean the total ruin of our civilization ? There is still perhaps time to turn back and give war once again the "human" aspect it had in the 18th century—if such a term can be used to describe the most terrible scourge that has ever threatened our race.

A U.S. Navy convoy heads for Thule, carrying supplies and equipment for the construction of the giant air base in Northern Greenland.

"Blue Jay"

On October 13th the "New York Journal-American" printed an article from the pen of Major Alexander P. de Seversky, pioneer airman, ex-aircraft manufacturer, aviation writer and amateur air strategist (author of "Victory through Air Power").

Major de Seversky strongly criticized the U.S. Air Force for having committed a "half-billion dollar blunder." This blunder, he wrote, the Air Force had made by building a huge air base at Thule, in Northern Greenland. The air base was only a little less vulnerable to air attack than an aircraft carrier. "To assume that this base, close to the enemy's backyard, would survive major attack by Soviet air power is wishful thinking."

Thule had come into the news only recently, although for some time it had been rumoured that a big American airport building project was under way in Greenland. It was on September 19th that the U.S. Defence Department announced scant details of the existence of the air base. And a look at the map immediately makes it clear that the feature most strongly criticized by Major de Seversky is the very reason for the construction of the base : namely, its relative proximity to the Russian mainland. Nobody will be deceived by the peaceful tone of the official release, which states that Thule "will be the gateway, or key point, of numerous global air lanes . . . a vital transit point of air transportation . . . a means to expand American air-rescue facilities in the North." While these statements are obviously true, it is equally a fact that, as the crow flies, Thule is only 3,000 miles from the huge Soviet industrial area behind the Urals—a mere six hours of cruising for heavy jet bombers like the Boeing B-52 "Stratofortress," about eight hours for heavy bombers of the Convair B-36 type—and an even shorter distance from Moscow. And you don't need 10,000-foot runways for air rescue purposes. Moreover, the Russians are fully aware of the significance of the base and are already reported to be taking counter-measures by building a similar installation somewhere on Franz-Joseph Land, the Arctic archipelago East of Spitsbergen and North of Novaya Zemlya . . .

Thule was named after *Ultima Thule*, the designation which the Greek geographer Pytheas gave to an island he discovered about 345 B.C. while navigating around Western and Northern Europe ; he claimed that the island (now believed to have belonged to the Shetlands) was the globe's most northerly land. For this erroneous assumption the unsatisfactory navigation facilities of the time may have to be blamed—or it may have been due to the fact that the man came from Marseilles (Massilia at the time) . . . Thule was again mentioned by Virgil as a "remote island" more than 300 years later when he wrote his "Georgica" between 37 and 30 B.C.

In 1910, the late well-known Danish Arctic explorer Knud Rasmussen established his forward base in the Cape York area in Northern Greenland and called the place *Ultima Thule*. He used it as the starting point for five expeditions to the North of Greenland and the American Arctic. A few years later, in 1927, Rasmussen described the strategic possibilities of an air base at Thule to his friend, Bernt Balchen, the Norwegian-born Arctic flier, now a Colonel with the U.S. Air Force. In 1950, after Rasmussen's death, Balchen mentioned the matter to Air Force Secretary Thomas K. Finletter, who ordered an exhaustive study of the feasibility of the idea. Today's air base at Thule is the result.

Nerve Centres of Air Politics

When the U.S. military services began working on the base, they did not call the undertaking "Thule." Instead, they named it "Operation Blue Jay"—and "Blue Jay" it has remained with the American inhabitants of this uninviting spot. "Blue Jay" is the most gigantic military engineering project undertaken by the Americans since the Normandy invasion of 1944, and probably also the most expensive. The Air Force admits that the installation has so far cost $240,000,000—about half the cost claimed by Major de Seversky. It took months of planning and 18 months of hard work to bring the base to its present stage of "near-completion." Finishing touches will bring the total construction time to over two years.

Building the base was an excellent example of inter-Service and military-civilian cooperation. The Army's Corps of Engineers was responsible for the construction work, the Military Air Transport Service (under the Air Force) and the Military Sea Transport Service (under the Navy) provided a steady stream of vitally needed supplies and equipment—including an air-lifted 30,000-lb. power shovel. In addition to the 3,700 military construction workers, 4,800 civilians were employed by the Services.

In March 1951, a small American-Danish weather station was operating at this desolate spot in the Danish Colony of Greenland, 900 miles from the North Pole. A small airstrip had been arranged to carry in the necessary supplies. This airstrip was used to fly in an initial batch of 600 construction workers, while the bulk of the nearly 8,500-man labour force was scheduled to go by ship.

The men building "Blue Jay" soon found that they had undertaken an extremely tough job—but they amply justified General Eisenhower's recent exclamation in another connection : "Since when has any job been too big for Americans ?" Yet, some of the difficulties seemed almost insuperable at first. It was found, for example, that Thule in its original state was nearly inaccessible to shipping. Pack ice threatened to crush the hulls of transports, countless ship's propellers were damaged. Ice-breakers had to plow lanes through the ice, icebergs had to be blasted and removed from the path of shipping. In the course of time, a 1000-foot pier was built, partly by the expedient of submerging old ships' hulls, and today the harbour facilities at Thule are capable of handling vessels of up to 10,000 tons.

Pack ice and icebergs were merely the first of many troubles. Others were the prevailing low temperatures (down to -50° F.), which made it impossible for men to work in the open for long periods at a time. The cold also resulted in leather, rubber, steel and other materials becoming extremely brittle, necessitating countless repairs to equipment. Water could not be piped into buildings owing to the cold and had to be delivered by truck. Gales and blizzards with winds up to 150 m.p.h. often made work in the open impossible. In summer, frequent fogs hampered shipping and air transport ; cargo aircraft in particular had difficulty in landing, owing to disturbances in navigation and radio equipment arising out of the proximity of the Magnetic North Pole, and to the location of Thule near the 10,000-ft. Greenland Ice Cap. In winter, construction was slowed by four months of uninterrupted Arctic night. Seas of mud, resulting from the thawing of the ground to a depth of four to six inches in summer, made runway construction difficult. But the worst troubles arose from what is known as "permafrost."

"Permafrost" is the ground permanently frozen to a depth of 1,000 feet or more by thousands of years of Arctic cold. The warmth of inhabited buildings erected on frozen ground gradually softens up the rocklike consistency of permafrost, as a result of which liquid mud seeps into houses, threatening to submerge them. Similarly, hard-surfaced runways are broken up by moisture welling up from the permafrost.

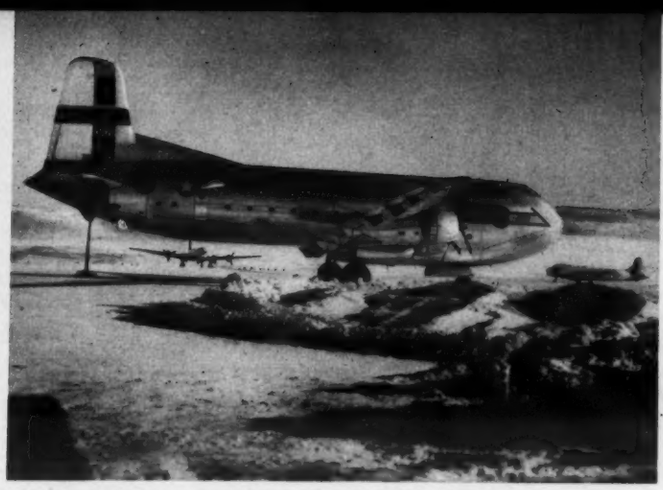
When ice packs prevent the movement of ships, many supplies are airlifted to Thule. This Douglas C-47 crew, in special Arctic garb, prepares to take off for Thule.

Icebergs were a constant hazard to supply ships, and hundreds of ships' propellers were damaged. A Bell HTL-4 helicopter flies past a Greenland glacier as it reconnoitres ahead of a Navy convoy making for Thule.

Pack ice threatened to crush the hulls of ships. The first convoys arriving at Thule in the early summer of 1951 had to stand off for weeks before they were able to land their men, equipment and supplies.

A landing ship (LST) about to unload men and trucks, including about half a dozen "Ducks," i.e., amphibian vehicles.

An Air Force transport aircraft over the frozen wastes of Greenland.



A big Douglas C-124 transport of the Military Air Transport Service on the new runway at Thule. In the background, two smaller Douglas C-54s. First flight from the runway was made September 11, 1951.

In runway construction the evil was overcome by insulating the concrete surface from the frozen ground by a deep layer of crushed rock.

For the erection of buildings, the problem was more complex. Lighter buildings were placed on "stilts" consisting of logs driven into the frozen ground to a depth beyond any possible chance of thawing ; the floors were then insulated with a layer of gravel or crushed rock. These buildings had to be weighed down with concrete blocks to enable them to withstand the Arctic gales. Heavier buildings, such as hangars, were also placed on piles at ground level, and their floors were insulated by a web of thousands of empty pipes measuring one foot in diameter.

Today, Thule is in full, year-round operating trim. Altogether, it covers about 600 acres, including a runway 10,000 feet long and 200 feet wide. Six large hangars have been built, four more are nearly finished ; huge fuel storage tanks have been completed, fed from an underwater pipeline system connecting them directly with tanker ships ; a large sea-water distilling plant, a 50-bed hospital, steam-heating plants, barracks, canteens and recreational facilities make garrison life possible.

Thule—or "Blue Jay"—is ready to play its strategic rôle at a moment's notice. Its civilian future will take longer to develop, but the base has already been included in one proposed commercial airline schedule—the California—Stockholm trans-Polar route which Scandinavian Airlines System hopes to inaugurate next Spring.

Improving harbour facilities, the U.S. Army's Corps of Engineers constructs a causeway as part of "Operation Blue Jay."

Prefabricated steel hangar components during the early construction stages at Thule air base. In the background, stacks of fuel drums.

The Air Power Aspect of Middle East Defence

BY ARNON AVINER, TEL-AVIV

1. SACME and MEDO:

At the beginning of October 1951 the Governments of the U.S., U.K., France and Turkey announced plans for the establishment of a "Supreme Allied Command Middle East" (SACME) and invited all nations in the area to join in the proposed organization. Thus the West made one further step in its endeavour to close the defensive ring around Russia. However, the SACME proposals met with complete failure because they were based mainly on the principles that guided the establishment of NATO and SHAPE, disregarding the fact that the background of local politics was completely different.

The first obstacle to joint Middle East defence lies in the lack of cooperation and in the political instability of the area. Naturally the main burden of Middle East defence must be borne by the nations in the area, and this is feasible only if these states cooperate with each other. Thus the very foundation for SACME or any other unified command is non-existent. Paragraph six of the SACME declaration, which may be regarded as the least acceptable, reads as follows.

> "The SACrME (Supreme Allied Commander Middle East) will command forces placed at his disposal and will develop plans for the operation of all forces within the area (or to be introduced into the area) in time of war . . . : However, the placing of forces under the command of SACrME in peace time is not a prerequisite for joining the common effort . . . : the movement of these troops . . . to or within the territory of States . . . will be made only with the agreement of the State or States concerned . . ."

The very idea of a SACrME has been distasteful to all Middle Eastern countries. In view of the Anglo-Egyptian and Anglo-Persian conflicts, no British Commander seems acceptable to the Arab States. The British do not want an American Commander because the bulk of forces in the area would presumably be those British units that are at present stationed throughout the Middle East. Neither the Arab States nor Israel would at the present stage be willing to put military forces at the disposal of a foreign regional commander. Again neither the British nor the Americans are likely to hand so important a Command to a French or Turkish General.

One is also tempted to doubt the likelihood of either Israel or the Arab States allowing the passage through or stationing of British ground and air units in their territories, except in an emergency—and then it may be too late. The passage or stationing of Israeli ground and air units in Arab territory and vice-versa is also out of the question at the present time.

Necessity being the mother of invention, the four sponsoring States have recast their plans which are expected to be made public in the near future under the new name MEDO *(Middle East Defence Organization)*[1] : the plan is said to aim at the elimination of the many objectionable features of SACME. In fact the new name implies that the idea of a Command, i.e., delegation of authority to some Commander, has been abandoned in favour of a *Planning Committee without command powers.*

It seems that, in view of the vital importance of the Middle East to the overall defence strategy of the West, the sponsoring States have decided that it may be better to do *something,* however little, than nothing at all. It is equally likely that, in order to press the issue, they must meet the demands and idiosynchrasies of the local parties more than half-way. Therefore one may assume that an agreement to MEDO by all States concerned will embrace roughly the following points :

A. All States in the area will have to give an assurance of their willingness to defend the Middle East against outside aggression.

B. The three main functions of MEDO will be :

(1) to establish a Planning Group of British, American and other military personalities in consultation with regional representatives, but not necessarily with the latters' active participation;

(2) to provide Middle East States with assistance in the form of advice and training;

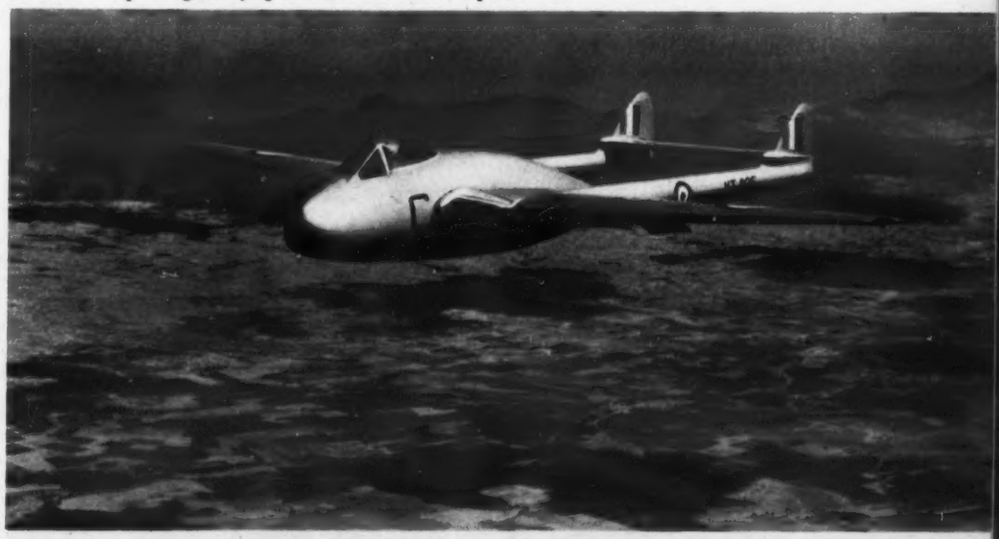
(3) to consider and recommend requests for arms and equipment when these are designed to further the needs of regional defence.

C. MEDO will aim at reducing present deficiencies in the capacity for defence so that the peace-time role of Middle East States may progressively permit a reduction of forces belonging to States not territorially part of the Middle East.

The question that should bother many a Western observer is whether such a new approach, based as it is on political concessions to the local parties, will really contribute anything to the solution of the problem. Since the Middle East's capacity for defence will largely depend on air power, I have attempted to examine the question from this particular angle.

[1] *Ed. note :* Newspaper reports published at the end of October stated that, as a result of the visit to England of the Turkish Premier and Defence Minister, the chances of the establishment of a Middle East Defence Organization were "excellent."

Will Cyprus become the headquarters of the planned Middle East Defence Organization (MEDO) ? Picture shows an RAF "Vampire" fighter flying over the island's central plain.



Israel's armed forces, including the Israeli Air Force, constitute the most efficiently organized local component of the Middle East's armed might. Above, troops parading on Israel's Independence Day.

2. The parties involved

Let us proceed by imagining that MEDO has materialised in the form of a military Planning Committee, established, let us say, at Cyprus. The task of planning the defence of the Middle East will be subdivided, with a sub-committee responsible for planning the air defence of the region.

The first task confronting this sub-committee which, for convenience' sake I shall term MEPCA (Middle East Planning Committee for Air), would be to examine the existing set-up of military aviation. There are altogether some eight military air components with which MEPCA would have to deal. These are Britain's Middle East Air Force, the Turkish, Egyptian, Israeli, Persian, Iraqi, Syrian and Lebanese Air Forces. In addition there is the Fleet Carrier Group of Allied Naval Forces, Southern Europe, under Admiral Carney, U.S.N.

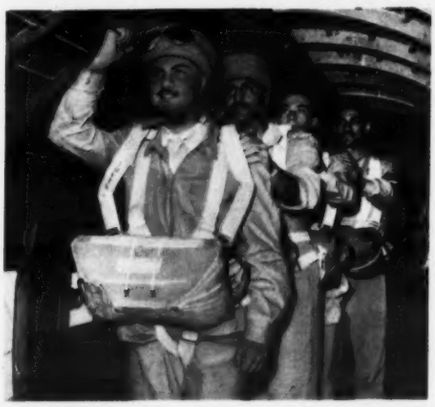
The total number of aircraft at the disposal of these eight land air components can be estimated at somewhere near 3,500, of which about one-third or 1,000 are combat aircraft in squadron service. Again about 30 % of these, or only some 300 aircraft and their crews, form the operational contribution of those States which, although members of MEDO, are not members of NATO. These are Egypt, Israel, Persia, Iraq, Syria and the Lebanon.

With the exception of Egypt, the Middle Eastern nations must rely exclusively on piston-engined operational aircraft of World War II vintage, as is disclosed in the following table :

	Egypt	Israel	Persia	Iraq	Syria	Lebanon
Gloster "Meteor," diff. marks	X					
D.H. "Vampire," diff. marks	X					
North American P-51 "Mustang"		X				
Republic P-47 "Thunderbolt"			X			
Vickers "Spitfire," diff. marks	X	X				
Hawker "Fury"	X			X		
Fiat G-55/59	X				X	X
D.H. "Mosquito," diff. marks	X	X				
Savoia S.M.-79						X
H.P. "Halifax"	X					
Avro "Lancaster"	X					
Boeing B-17		X				

This shows that there are at least 12 operational types of combat aircraft including eight different types of fighter and fighter-bomber in the Middle East. Such a large number of types, especially in relation to the small total strength, is hardly conducive to efficiency. The diversity is the outcome of arms embargos imposed by the U.K. and the U.S. after the outbreak of war in the Middle East in 1948. Consequently, countries had to purchase their flying equipment wherever they found it. Thus a number of European countries and the USA conveniently disposed of surplus war-time stocks in appreciable quantities.

Egypt's Air Force is one of the oldest in the Middle East. Among the six regional Air Forces it is also numerically the strongest. Until 1948 the *Egyptian Air Force* (EAF) developed only slowly. It was equipped and trained purely for defence ; hence its failure when cast in an aggressive rôle during the Israel-Arab war. When hostilities ceased, the Egyptians went to work on a large-scale reorganization programme. The unwelcome appearance of a stronger neighbour, coupled with the need for reestablishing the country's impaired military prestige, deeply influenced Egypt's military air policy. In the assumption that the power ratio between Egypt and her neighbours offers a chance of all-out victory, Egypt has geared her war-making potential to an offensive concept. Great emphasis is laid on cooperation of air and ground forces. To increase its offensive punch, the EAF purchased heavy bombers (in the World War II sense). Without doubt the EAF has greatly improved in organization, administration and technical ability. Both numerically and qualitatively, it is a much better fighting force than at any time in the past.



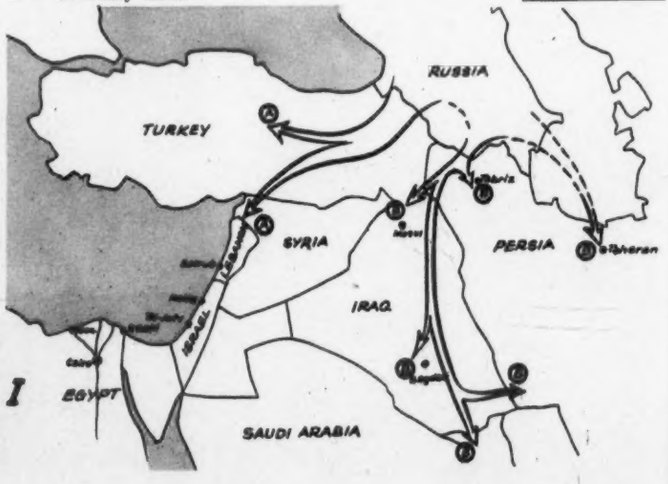
Egypt's Air Force is the largest and best equipped local air arm in the Middle East. Earlier this year, an Egyptian Parachute Brigade was formed. Here paratroopers are learning how to prepare for jumping.

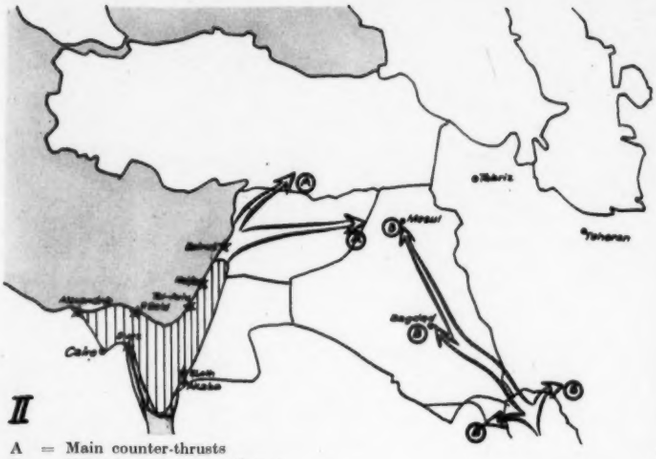
The *Israeli Air Force* (IAF), created perforce during the 1948 war, to-day is qualitatively the best fighting force in the Middle East. Measured by Western standards its equipment is out-dated, but from the point of view of organization, administration, technical ability, standard of training and morale the IAF is

Israeli guerilla forces organized in "jeep commandos" during the war with the Arab countries.

A = Main thrust
B = Secondary thrust

MAP 1




II
A = Main counter-thrusts
B = Diversionary counter-thrusts
★ = Disembarkation ports for reinforcements
= Area of concentration and springboard.

MAP II

Biggest component of air power in the Middle East is the RAF's Middle East Air Force. Picture shows three RAF D.H. "Mosquito" fighter bombers over a tanker in the Suez Canal.

second to none. The development of the IAF has also been decisively influenced by the Israel-Arab war and the uneasy armistice that followed. The country's geographic position, shape, limited size and unfortunate concentration of industry make air defence extremely difficult. Consequently Israel's defensive doctrine has also evolved around an offensive concept of aerial warfare. The British military commentator, Capt. Liddel Hart, quite correctly pointed out that "continued tension between Israel and her Arab neighbours is an obvious handicap to combined action to meet the menace of a Russian invasion, but it may have some compensation in stimulating efficiency all round."

The *Imperial Iranian Air Force* (IIAF), created in 1924, ranks third by virtue of its quantitative and qualitative strength, its spirit and technical ability. One of the main responsibilities of the IIAF has always been to preserve internal security and control over rebellious border tribes. Consequently the IIAF is composed mainly of fighter-bomber and transport units for the purpose of dispersing rebellious tribes and transporting troops rapidly from one place to another. Due to the fact that Persia lies directly in the Soviet line of fire, active U.S. interest in its military potential increased in proportion to the East-West estrangement. In 1947 a military advisory mission was set up and some dollar credits were allocated for rearmament, but on the whole these efforts have not been very successful.

The *Iraqi Air Force* is rather small for its long—and, indeed, checkered—career. As a protegé of Britain it has been equipped with Hawker "Fury" fighter bombers. Its operational squadrons have had a chance of participating in the annual manoeuvres held by the British MEAF in that country. In spite of British assistance, morale seems rather low and capacity for defence is small.

The *Syrian Air Force* is still very small. Operational units are equipped with Fiat G.55 and G.59 fighters. Standards of training and operational efficiency are of a low order.

The *Lebanese Air Force* is as yet negligible. The number of military aircraft can be counted on the fingers of both hands. Neither the existing nor the potential air power of this nation is likely to arouse the interest of MEPCA.

3. Common problems

The foregoing information throws some light on certain basic problems affecting the air power programme of the nations concerned.

Any and all of the Air Forces involved will have great difficulty in sustaining a maximum operational effort for any length of time. The estimated maximum period of operational effort varies considerably in each case from a couple of days to a maximum of several weeks. This is due to a number of reasons, some or all of which are applicable in each case. They are :

a) Second-hand equipment.
b) Lack of adequate reserves of operational aircraft.
c) An even more critical shortage of reserve crews.
d) Deficient field and/or base maintenance.
e) Low morale and lack of confidence due mainly to insufficient training.

Of course all of these defects are remediable. Second-hand equipment can be exchanged for up-to-date types, the number of reserve aircraft can be increased, training can be stepped up to ensure an adequate supply of reserve crews in an emergency, and better aircrew and technical training will serve to raise morale. All this will require a lot of money, effort and, what is most important, time.

Furthermore, civil aviation in the Middle East is undeveloped ; there is no aircraft industry to speak of, whilst aeronautical facilities are few and widely scattered. Neither is a survey of the *potential* air power very promising. With all these factors in mind MEPCA planners must consider from the outset that in time of war Middle East air power will have to be largely sustained from European and other sources to avoid rapid obliteration.

A study of these factors in relation to the geography of the area reveals that proportionally small forces will have to defend a vast area. While important strategic areas are relatively few, they are widely scattered. Therefore limitations in size and numerical strength must be offset by extreme mobility. The factor of mobility in an area such as the Middle East assumes such proportions that special mention will be made of it at a later stage.

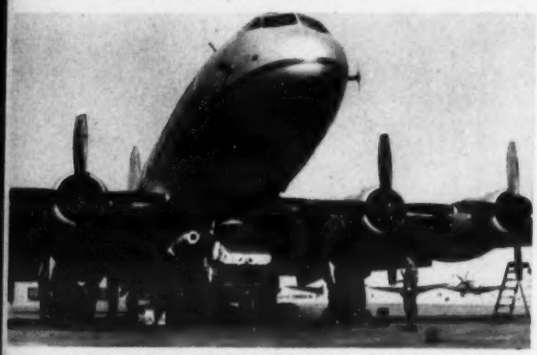
The Imperial Iranian Air Force is equipped mainly with fighter-bombers and transports. A squadron of Republic P-47 "Thunderbolt" fighters is preparing to take off from Ghali Morghi air base.

A comparison of the air power potential of Middle East Nations

Note : Highest number of points possible : 24
Lowest number of points : 6
4 points per classification — excellent
3 " " " — good
2 " " " — average
1 " " " — unsatisfactory

	Israel	Egypt	Lebanon	Iraq	Syria	Jordan
a) World geographic position	2	2	2	2	1	1
b) Geographic position in Middle East	4	2	3	2	1	1
c) Internal air transport potential	1	3	1	2	1	1
d) Manpower (qualitatively and numerically)	3	2	1	1	1	1
e) Aircraft industry potential	2	2	1	1	1	1
f) Natural resources	1	1	1	1	1	1
	13	12	9	9	6	6

A British parachute brigade is stationed in the Middle East. A jeep being attached to the underside of a H. P. "Hastings" transport.



This simple survey points to a number of basic conclusions :

a) Re-equipment of Middle East air forces with up-to-date equipment is essential.

b) A re-equipment policy must aim at fewer types and more aircraft, i.e., standardisation.

c) To become effective with a minimum number of aircraft operating over large areas, Middle Eastern air power must become a model of flexibility and mobility.

4. Military crystal gazing

General Douhet wrote : " . . . Organization of the air arm depends upon what it is to do. Hence, study of its use precedes and determines its organization . . ." But study of its use must be preceded by an estimate of the different military situations that may arise in the event of war.

According to the general theme as exposed in an article by Capt. Liddel Hart last year, there is practically no chance of holding the Middle East directly. The Russians, by way of Persia, may invade Iraq and thus occupy the central area. But it would be difficult for them to operate large forces beyond the Syrian and Jordan desert belts in an endeavour to take the coastal fringe. The disadvantages of an attack from this direction being obvious, it seems doubtful whether the Russians would even try to take the fertile crescent in this way.

The economic importance of Persia and Iraq as a source of oil is sufficient to warrant a Russian invasion in spite of the threat of retaliatory atomic bombardment.

In addition, we must think of a Russian invasion of the Middle East as a preventive manoeuvre, in that it may be motivated by Russia's desire to eliminate the possibility of a Western build-up in the area. The Middle East region offers itself as an ideal springboard for a Western counter-offensive against the war-making potential of Soviet Russia. Since the area of a possible Western build-up would be confined mainly to the coastal fringe along the Mediterranean coast, including the Lebanon, South West Syria, Israel and Egypt, the direction and route of a possible Russian invasion seems to be clearly indicated (see map I). Logical counter-moves are depicted on map II. With these considerations in mind we may proceed in our basic assumptions and anticipate the aerial moves of the game.

In support of its invasion through Turkey, Persia and Iraq, Russian air power will aim first at the attainment of air superiority over the combat areas ; it will also be employed in direct support of ground operations. Its short and medium-range attack aviation will be committed en masse. A third possibility would be the establishment of a tactical blockade by isolating the areas of operation from the coastal fringe, thus hindering the flow of Western supplies and reinforcements.

In the assumption that a Russian southward thrust via Eastern Turkey and along the Mediterranean coast can be stopped—it being unlikely that a parallel drive through Persia and Iraq towards the Persian Gulf could be halted—we may anticipate the *second* and "static" phase of operations. During this phase the Russian air effort will probably be aimed at (a) defending the newly acquired possessions, particularly the oil fields and refineries, (b) at preventing an effective build-up of forces in the area of concentration along the Mediterranean fringe. The latter aim will call for an all-out bombing effort against the Mediterranean and Red Sea ports and harbour facilities.

The *third phase,* i.e. the ground and aerial counter-offensive, is of no importance to present calculations because the air components of the Middle East states would then be relegated to a secondary rôle.

Of course all this is pure conjecture and may seem rather far-fetched, but even if the details of the picture thus presented are not altogether correct, the basic outline will decisively influence the organization of Middle East defensive air power.

5. Practical aspects of planning

The considerations affecting the practical aspects of planning Middle East air defence may be divided into two kinds. First, the type of air defence organization to be created depends on the general background of military situations as envisaged, including the balance of forces, general war aims of the opponent, the probable employment of his air arm, geographic, climatic and meteorological factors. Once the kind of air defence organization needed is clearly visualised, the ways and means of establishing it must be sought. This can be done only by a careful evaluation of the resources of each of the States involved, due consideration being given to the background scenery of intricate Middle East politics. This practical task is likely to give MEPCA planners many headaches.

6. Type of air organization required

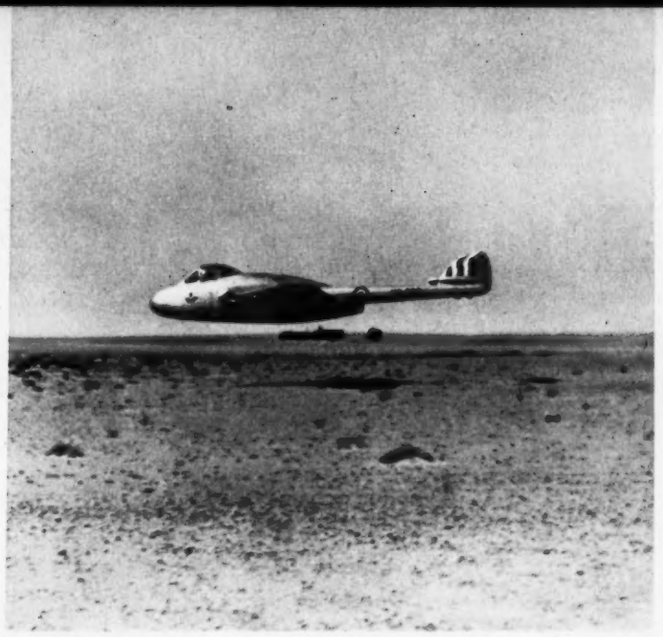
In the event of war, the Middle East air forces or Air Command will have to carry out two distinct tasks. First it must support the ground forces in the battle zone and aid them in making a stand or orderly retreat whichever case may arise. Particularly along the Persian and Iraqi invasion routes air support forces will be called upon to slow up the rate of Russian progress by attacking roads, bridges and other tactical targets. Warfare in territories like Persia and Iraq, the Syrian and Jordan desert belts must be mainly one of movement, i.e. the rapid manoeuvring of relatively small forces in a large area. Such a war of movement, reminiscent of the desert warfare during the North African campaigns of 1940-1942, requires extreme mobility of both air and ground forces. Since mobility has been defined as "the power to apply concentration of force rapidly at any given point," operational squadrons require an extensive chain of airfields and landing grounds. They must also be able to move constantly and fight at the same time.

In moving operational squadrons at a moment's notice and simultaneously ensuring

Air power in the Middle East also includes the Fleet Carrier Group, Allied Naval Forces, Southern Europe. This consists largely of U.S. aircraft carriers and operational squadrons. Picture shows the carrier "Philippine Sea" leaving Grand Harbour, Malta.

= Interception area
= Minimum radar warning area

MAP III



The Middle East deserts offer excellent terrain for low-flying practice and ground attack. A "Vampire" of MEAF.

adequate mobility for the ground forces, the importance of air transport cannot be over-emphasised. In view of the lack of roads and railways, the extent of air transport required bears no relation to any other known theatre of operations.

The all-weather day and night defence of the coastal fringe is the third and all-important task falling to Middle East air power. The coastal fringe contains the war potential of the Middle East, reinforcements and war materials will flow through the ports of Alexandria, Port Said, Suez, Akaba and/or Eilath, Tel-Aviv, Haifa and Beirut. Along the surface lanes of transport leading from these ports to the interior, supplies, equipment and troops will move to their respective centres of assembly, storage and distribution. It is here that armies and air forces can be assembled for a counter-offensive. It is this area, too, which will draw the attention of the Russian strategic and longer-range tactical air components. If the Russians do not succeed in taking the base from the ground they would try their utmost to neutralize it from the air.

The establishment of a modern air defence organization with its radar nets, control rooms, interceptor units, etc., is complicated and expensive. Therefore it will not be possible to spread an organization over the entire Middle East except, of course, for the early warning radar coverage. The defensive effort must be concentrated on the most vital target area (see map III).

Such a policy might, of course, have an adverse effect on countries or territories left out of the defensive system ; however, they might find some consolation if the motives behind anticipated Russian moves are clearly understood. A Russian thrust towards the Persian Gulf would aim at the occupation intact of the sources of oil. Hence, the danger of devastation would depend chiefly on the extent of retaliatory bombardment by the West.

Quite different would be the purpose of a Russian thrust towards the coastal fringe. Here purely military considerations override any economic points of view. What would matter would be to make that base unfit as a supply base and springboard for a counter-offensive. The difference of motive would certainly be reflected in the degree of intensity in fighting and in the ferociousness of the air war over the base.

The air defence of the coastal base has some natural advantages. The area is moderate in size, and since the general direction of Russian air attack can be anticipated, the defensive effort can be rapidly concentrated. Furthermore, as the area is shaped like a sausage lying in the general direction of the anticipated air attack, defence in depth is possible. Finally, the size of the adjacent territories makes it possible to move the early warning line a considerable distance from the actual danger area. Russian bombers en-route to attack the Suez canal zone would have to cover about 500 miles (one and a half hours), and would be constantly exposed to interception.

7. Means to an end

Thus the future shape of Middle East military air power will be based on: (a) an air support force with an exceptional degree of mobility, (b) a very large air transport force and (c) an efficient air defence organization for the coastal fringe. The geographic distribution of present-day air power suggests that training and re-equipment of existing air components be carried out with an eye to the development of the Persian, Iraqi and Syrian Air Forces as ground supporting elements—which incidentally they are to-day—whereas the Lebanese, Israeli and Egyptian Air Forces be developed mainly for fighter defence.

In the present circumstances none of the Middle East States is likely to agree to such a policy, because each would seek to develop a balanced air arm with both offensive and defensive capabilities. But *six balanced Air Forces in the region would only result in completely unbalanced air power.*

None of the regional States is in a position to furnish even part of the required air transport fleet in time of war, so that this responsibility would have to be mainly shouldered by the British MEAF or the USAF. The civil air transport fleets of the twelve local airlines (Cyprus Airways, Air Liban, Air Jordan, Middle East Airlines, Syrian Airways, Arab Airways, Iraqi Airways, Iranian Airways, El Al, Arkea, Misrair, SAIDE), comprise some 70 aircraft, of which about 45 are suitable for international air services. In wartime Middle East airlines may contribute by relieving pressure on the big international operators.

The dependence of Middle East air power on supplies from the West has already been noted. To alleviate the adverse effect of this dependency, especially during the initial phase of a war when many of the supply routes may be cut, some measure of material self-sufficiency should be provided. The storage of considerable quantities of aircraft components and the creation of assembly facilities in the Middle East might be of considerable help. But here again the facilities for storage, assembly, component production and distribution could not be duplicated in every individual State. Here is another problem in store for politicians and military planners.

Lastly, to develop the effectiveness and striking power of air defence, frequent joint manoeuvres and air exercises must be organized. While some exercises can be held by individual countries, a high degree of coordination and efficiency can only be achieved by combined regional exercises based on actual wartime conditions. Such exercises would require complete team-work between the various national air components.

This brings us back to our point of departure: once again the question arises whether there is any chance for MEDO to steer a middle course between military necessity and conflicting political ambitions. An answer is not possible at this time, but one thing is clear : without internal peace in the Arab world and good relations between the latter and Israel, there can be no real cooperation. A MEDO resigned to and accepting the present Middle East political crossword puzzle will achieve nothing. On the other hand, if MEDO succeeds in bringing the various States into a closer association based on mutual confidence, on the full exchange of information and facilities, then the task of rebuilding Middle East air power may well be worth while.

Marine Cavalry of the Air

During last summer's war games on Onslow Beach, N.C., U.S. Marines manoeuvre under simulated threat of A-bomb attack. These light supporting elements, which would not be so tightly grouped in combat, are held up (in the picture) by an umpire radio team (lower right) who are describing the situation to helicopter-borne Marines aboard widely dispersed aircraft carriers. Airborne Leathernecks will shortly launch the main assault.

The old joke about somebody having served in the Horse Marines seems to be on the point of losing its point—for the U.S. Marines have given their helicopter assault units an even more outrageous name. They call them "Cavalry of the Air."

Marine helicopters are old stuff—or nearly. For some time the "Leathernecks" have been evolving tactics for the use of rotary-wing aircraft in assault missions. A brief report on their exercises with Piasecki HRP-1 twin-rotor machines appeared in *Interavia Review* for March 1951. In the autumn of the same year a fleet of 21 Sikorsky HRS-1 (S-55) twelve-seaters deposited 300 U.S. Marines on a hill-top overlooking the enemy in Korea, with eight tons of equipment.

American experts believe that helicopters are destined to become the spearhead of amphibious warfare. Operating from fast carriers, they have the advantage of enabling the ships from which they take off to disperse—and dispersal is the only effective antidote to atomic bomb attack. The old type of massed amphibious landings used in Normandy would indeed have offered an ideal target to the A-bomb of today.

The helicopters bring in the troops, complete with their initial fire power, and then act as flying cranes to move up supplies. In sup-

Six Marine transport helicopters loaded with combat Marines sweep over defence lines behind the beach at Camp Le Jeune, N.C.

The Marines have landed and rush at the double to take up position. The HRS-1 helicopter is the same type as that used successfully in Korea by the First Marine Division.

Aboard a carrier, fully equipped Marine assault troops board Sikorsky HRS-1 (S-55) transport helicopters far out at sea. This is the beginning of a leap-frog manoeuvre to hit the enemy where he doesn't expect it. Seven thousand Marines, two dozen ships participate in the exercise.

Marine transport helicopters taking off from their carrier with their full complement of troops. Note the absence of doors on the troop compartment, to facilitate rapid unloading after landing.

port of amphibious landings of a more conventional nature, they can land troops behind the enemy's coastal defences to put out of action any atomic artillery or guided missile installations he may have in readiness to beat back the invaders. Finally, helicopters can also be used for evacuation if a situation becomes untenable : in the past, when paratroops and glider-borne infantry had been committed to action, they lost their mobility and often had no means of retreat.

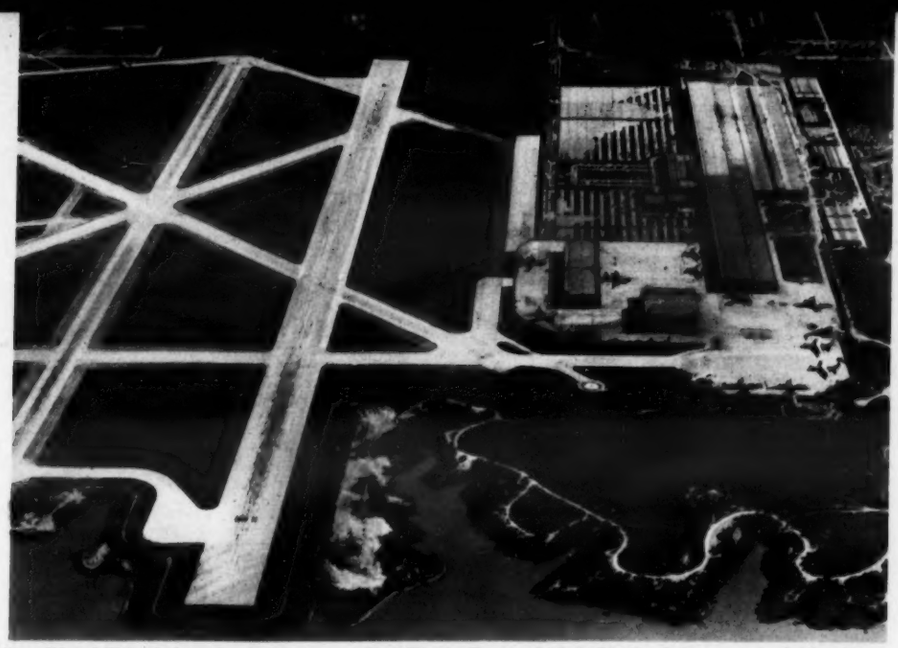
The photos on these pages, carefully edited by the U.S. Defense Department, illustrate the culmination of four months of experimenting and exercises by Leathernecks of the Fleet Marine Force of the U.S. Atlantic Fleet last summer. The scene is Onslow Beach, at the Marine Corps' Camp Le Jeune training centre, North Carolina. The exercises, simulating an amphibious assault on an enemy beach, involved 7,000 Marines in air and ground teams.

The attack was launched by the Atlantic Fleet Amphibious Force, including two dozen naval vessels, Marine aircraft from the Marine Air Station, Cherry Point, N.C., and the "Cavalry of the Air" operating from widely dispersed aircraft carriers at sea off the North Carolina coast. After a seaborne assault had hit the "defended" beach, combat troops in Sikorsky HRS-1 (S-55) helicopters dropped behind the enemy's lines to knock out his coastal defences.

As three Marine transport helicopters land troops from Navy carriers at sea, six other 'copters head back to ship to act as flying cranes bringing supplies to "air head." Marine fighter aircraft provide protection for the helicopters and the troops on the ground.

The "flying crane" returns : helicopters rush in ammunition and supplies to reinforce position of attackers who have struck in rear of defences during U.S. Atlantic Fleet Amphibious Force war games at Onslow Beach, N.C.

Building Big Bombers



Consolidated Vultee's huge bomber factory at Fort Worth, Texas, which builds the B-36 ten-engined (six piston, four jet engines) intercontinental bomber. The main runway of the field is more than 10,000 feet long. Looking at the plant proper, the materials and subcontract parts warehouses are at extreme right; the shorter bay of the main plant, 120 feet wide, houses the parts manufacturing area and the tools section. Left of it is the 4,000-ft. assembly line. Projecting from the latter, at left, is the office building. Hangars at lower left of assembly bay are used for last-minute modification. Delivery row is at lower end of paved area. Thirteen of the big bombers are visible in factory area, another is on the taxi strip at top left of photograph.

Building the big Consolidated Vultee B-36 ten-engined heavy bomber, the largest combat type in squadron service today—it spans 230 feet and grosses nearly 280,000 lbs.—at a plant initially designed for the production of Convair's B-24 *Liberator* war-time "heavy bomber"—span 110 ft., gross weight 62,000 lbs.—created problems like those a man planning to make motor trucks in a toy factory would meet. However, Consolidated Vultee Aircraft found that its wartime plant at Fort Worth, Texas, has been proportioned so generously for its original purpose that it could handle even the quantity production of the giant intercontinental bomber without too much difficulty.

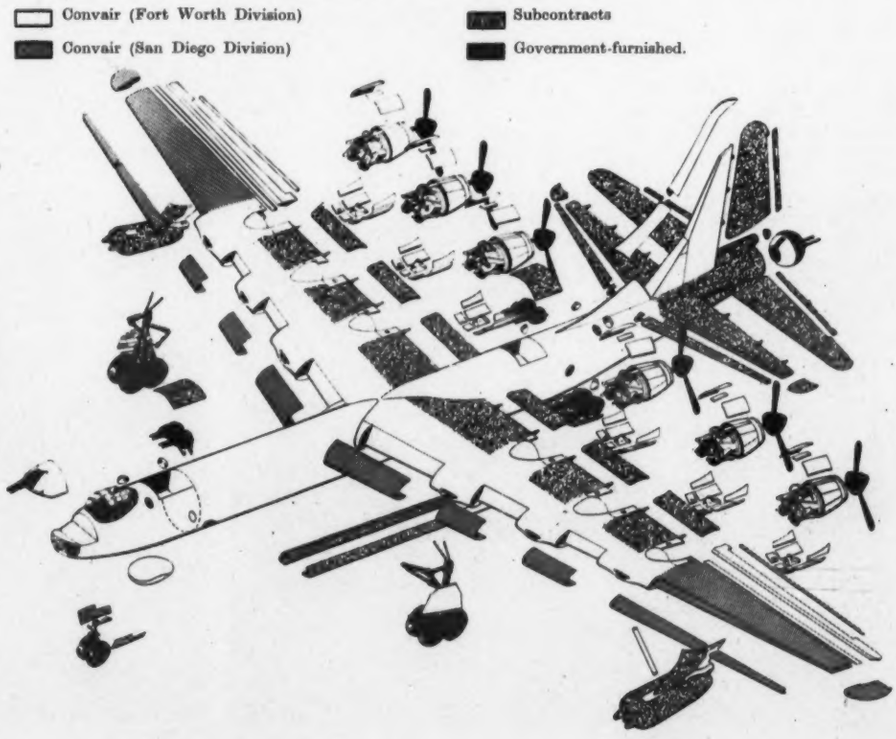
How many of the big A-bomb carriers Convair has delivered to the Strategic Air Command of the U.S. Air Force is a secret, but the disclosure that 107 B-36's were damaged by a tornado last September at the adjoining Fort Worth and Carswell airfields indicates that the number is considerable. Total orders for the type are believed to be substantially in excess of 200, and the Fort Worth factory will keep the type in production until some time in 1954.

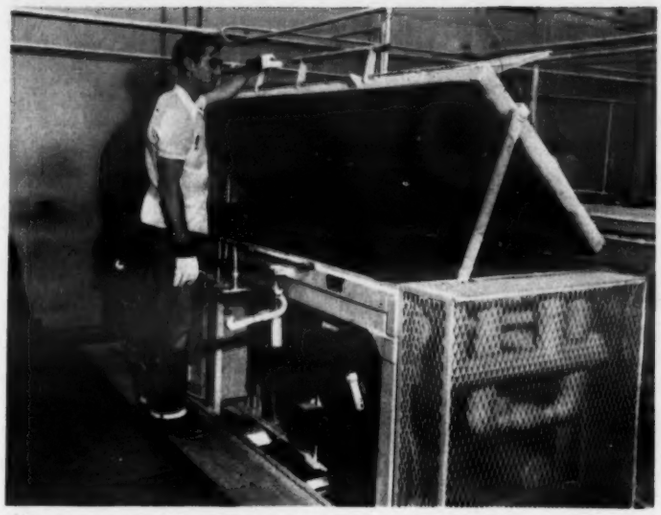
The Fort Worth plant consists of a main assembly bay measuring 4,000 ft. by 200 ft. (at left, in photograph); of a parallel tooling and parts plant, shorter than the main assembly bay and 120 feet wide; directly adjoining are warehouses for materials and parts supplied by subcontractors. This simplified arrangement, dubbed "integrated assembly line," makes possible a smooth production flow easier to control than a process in which parts arrive at the assembly line from a dozen different buildings.

Most of the problems involved in building the large bomber are similar to those encountered with other types of aircraft. Differences are merely a matter of degree. The whole manufacturing cycle is obviously much longer, simply because it is not possible to turn out large aircraft as fast as fighters. The number of parts to be assembled is vastly greater: there are 68,000 part numbers per bomber, often with two parts per number because of right and left locations. Each aircraft consists 8,500 sub-assemblies.

In addition, parts and components are much larger and therefore require special installations for transportation to final assembly. Work stands, jigs and fixtures must be correspondingly outsized. The huge size of the aircraft is also reflected in the outdoor transportation difficulties Convair had to overcome. A specially-built 91-foot trailer-truck had to be obtained for hauling horizontal stabilizers from the subcontractor in Dallas to the Fort Worth plant. Jet pod assemblies arrive in another specially-built truck from Bell Aircraft's North Fort Worth plant. Rudders are carried,

Who makes what of the B-36. Engines are also Government-furnished.





Skin parts are glued together by Convair's "Metlbonding" process in this presser, with simultaneous application of heat.

Sub-assembly : hat-section structure of control compartment enclosure being located and clamped into position prior to spot-welding. The stainless-steel structure is cross-hatched to controlled dimensions so that the glass panels will fit properly.

one at a time, in a low-slung truck from Luscombe Airplane's factory at Garland, Texas, 20 miles north-east of Dallas. Finally, a custom-built truck hauls tail-cones, two at a time, at slow speed all the way from AVCO's Nashville, Tennessee, a distance of more than 800 miles.

On the other hand, the large size of the B-36 also has its advantages. For instance, fitting of electrical circuits and other intricate installations is greatly facilitated because workers can crawl right into wing and fuselage areas of the B-36, whereas similar work in the confined spaces of a thin fighter wing is extremely difficult and slow.

In the early stages of manufacture, the work flow moves crosswise through the plant, beginning at the warehouses west of the fabrication area. Raw stock is supplied from

Sub-assembly and major assembly of B-36 bomb bay. At upper right are major assembly fixtures for bomb bay truss structure and bomb bay itself. Area in foreground and at left is sub-assembly.

Primary assembly line of B-36 nose and forward bomb bay. A pilot's enclosure is being installed on nose structure in foreground. Aft section of bomb bay, mated to tail, with tailplane and dorsal fin extension attached, is shown in right foreground.

Bomb bay doors, main landing gear doors and interior furnishings are installed at this station on the assembly line. Aircraft are still moving straight ahead, as outer wing panels have not yet been fitted.

warehouse to the parts plant (parallel to main assembly line) manufacturing detail parts by forming, drawing, stretching, shearing, welding, heat treating and anodizing. In this connection Convair has developed a special process called "Metlbonding," in which metal surfaces are glued together with a synthetic bonding material, combined with the application of heat under low pressure.

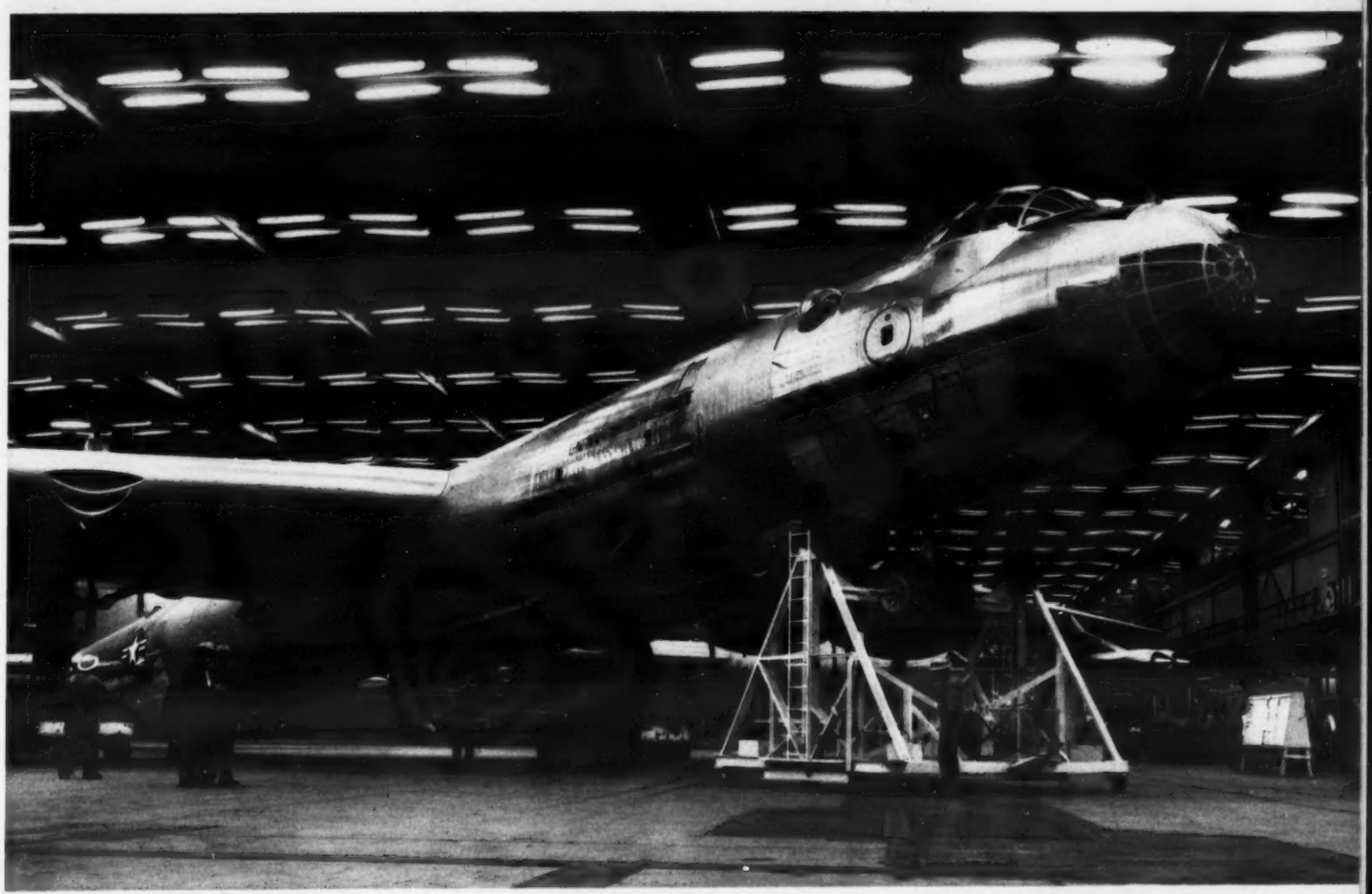
The parts plant also contains a two-storey section reserved for the tooling department. The ground floor of this section houses the heavy machine-tools employed in making production tools. On the upper floor templates, form blocks and other items requiring lighter machines are made.

From the parts plant the components now again move west to "major assembly" at the start of the straight, 4,000-ft. assembly line. From here the large fuselage and wing components go forward to major "mating stations" and then on to the 11-station final assembly line. Parallel to the final assembly line are the areas for buildup of components which are installed progressively as the aircraft moves down the line. Some of these components are prepared by the parts plant, while others are fed in to the line from the subcontract parts and Government-furnished equipment warehouses. The last three stages of the assembly line are reserved for checks on the electrical, hydraulic and armament systems and for Air Force inspections.

The huge major assemblies of the aircraft are moved to their respective mating stations by an elaborate overhead monorail system which eliminates movement of large components from place to place on the floor and thus saves much space. When they are ready for installation, they are lifted vertically and carried to their proper station. The 28,000-lb. wing centre section, for example, is lifted up by four monorail cabs, one of 15-ton capacity and three of five-ton capacity. The fuselage is moved in two sections, one comprising the nose and forward bomb bay, the second the aft bomb bay and tail. Two five-ton cabs are used for each of the two sections. Each of the fuselage components moves five times from the time it leaves the bucks to its arrival at the major mating point. Altogether there are 23 monorail cabs in the Fort Worth plant.

After leaving the assembly line, the B-36 is towed by tractor to testing installations outside the plant for check-ups on engines, guns, radar and compass. The aircraft is then flight-

B-36 are placed at a 45° angle across 200-ft. assembly bay to permit fitting of outer panels, bringing total span to 230 feet. At this point, jet engines are also installed, engine clean-up is begun, all control surfaces are rigged and completed. Note top of vertical fin disappearing in roof truss.



Nose high and still at its 45° angle, a B-36 (in this case an RB-36 reconnaissance bomber) is ready to be pulled off the end of the final assembly line. The nose has to be jacked up 10 feet to lower the 47-foot-high tail sufficiently to clear roof trusses.

tested by company pilots, who are followed by USAF crews for acceptance flights. Upon completion of the latter, the machine returns to the plant to be fitted with "loose equipment," such as gun turret covers, engine covers and bomb racks. After that it is taken to the delivery row for the Air Force to take over.

Several special "tricks" have to be resorted to in the final assembly stage to make possible the building of a 230-ft.-span bomber in a 200-ft. bay. To prepare for the fitting of the outer wing panels, the aircraft has to be set at a 45-degree angle across the bay to make room for the span. From that point onward the bomber moves down the line on trolleys at the same angle. Furthermore, after installation of the vertical fin and rudder, the nose of the B-36 has to be jacked up 10 feet for every line move to lower the fin sufficiently to clear overhead roof trusses.

A special problem in the production of aircraft the size of the B-36 has to be faced in the form of factory safety precautions. A major number of the workers are continuously engaged on jobs high above the floor, and a fall nearly always produces a serious accident. The answer has been to build unusually large elaborate work stands, and the accident rate at Fort Worth has been conspicuously low.

From the production tooling point of view, Convair is proud of the low average number of tools-per-part which has been achieved in the Fort Worth factory. While this is due partly to the fact that the B-36 is not a mass-production aircraft requiring large numbers of identical parts within a short time, other factors have contributed to this result. A small number of tools per part was fabricated to produce the initial series of 13 bombers. As contracts were raised, the tools-per-part average has increased, but the figure is still exceptionally low for the U.S. aircraft industry. This result has been obtained by the standardization of special mechanical press parts, the development of standard dies usable for numerous parts, and use of a joggling machine developed at Convair which eliminates joggling dies for 85 per cent of all joggled parts.

At present, Convair's Fort Worth plant has a work force of about 25,000, of whom more than half are employed in the factory, the others in the design, engineering and administration offices; total payroll exceeded $100,000,000 in 1951. In addition, 1,610 subcontractors, spread over 36 states, supply materials, parts and services—quite apart from the manufacturers of Government-furnished equipment, such as engines, propellers, wheels and armament.

Although B-36 production is scheduled to be "phased out"—as the official jargon goes—by 1954, the Fort Worth plant will not be idle. Last July, the Under-Secretary of the U.S. Air Force Department, Roswell L. Gilpatrick, told Convair officials that the mammoth facility will be kept busy on "other essential work . . . involving new prototypes."

Starfire Salvo

Fire and smoke pour back over the "Starfire" as a salvo of nine 2.75-inch Aeromite rockets flashes from the firing tubes.

A fraction of a second later the rockets streak far ahead of the fighter, "zeroed-in" on the target. Any one of the 24 rockets normally carried by the F-94C is powerful enough to knock down the largest bombers now in existence.

Wake of smoke swirls back around the "Starfire" as it begins to pull away.

The pilot of the Lockheed F-94C "Starfire" two-seater all-weather fighter *(Interavia Review* No. 8, 1952, page 443) experiences an exciting moment when he flips the trigger that sends a salvo of 2.75-inch rockets blasting out of the aircraft's nose. A brilliant burst of flame completely encircles the machine's nose section with a bright, hot halo, and the canopy and entire fuselage section are engulfed in a sudden cloud of black smoke. With the rockets well on their way, the aircraft remains almost hidden in their smoke trail. Not until the departing rockets are very far ahead does the "Starfire" begin to emerge from the smoke cloud, giving the pilot his first visual glance at the success of his aim. *(Editor's note :* Not all rockets produce such an enormous quantity of smoke, and there seems a possibility that special demonstration rockets were used in the pictures shown here.)

The "Starfire" normally packs two dozen rockets in a ring around its nose, but it can carry more in wing pods. Those in the pictures on this page are "Aeromites," produced by Aerojet Engineering Corp. In the foreground is a Lockheed T-33 two-seater trainer serving as camera aircraft, photographed from another T-33.

The "Starfire," carrying a pilot and a radar operator, flies almost wholly automatically when pursuing and attacking his target. Observers at ground radar sets "talk" the pilot close enough to invading bombers for the fighter's radar to pick up the target. Once in radar contact, the "Starfire" electronically locks onto its prey, tracks it, closes the distance at about 600 m.p.h., takes aim and fires.

A "Starfire" at rest. Rockets are housed in ring around the nose just aft of the black radar dome. Cover retracts to enable pilot to release rockets, singly or in salvo.

The SAAB-32 "Lansen"

On November 3rd, 1952, the *Saab-32* (Air Force designation A 32), a new Swedish all-weather jet aircraft for attack operations on land and sea targets, made its successful first flight. This aircraft has been designed and built by the Svenska Aeroplan AB. of Linköping, for the Royal Swedish Air Force, according to Royal Swedish Air Board specifications.

Compared with the Saab-29 (J 29) swept-wing jet fighter now in large-scale production and squadron service, the Saab-32 is considerably larger and designed for higher speeds. Its top speed is in the region of 700 m.p.h. (over 1,100 km/h). It is powered by an undisclosed version of the British Rolls-Royce "Avon" axial-flow engine.

Distinguishing features of the long and slender Saab-32 are the flush air intakes in the fuselage sides, and the big fairings used to smooth the airflow at the root of the movable tailplane. The wing, tailplane and fin are sharply swept back, the angle of sweep being greater than that used on the Saab-29. The thin wing is fitted with large trailing edge Fowler-type flaps and with leading edge slots similar to those used in the Saab-29, which improve stability and manoeuvrability at stalling speed. Both ailerons and elevator are equipped with hydraulic booster control.

Like all modern Saab-built aircraft, the "32" features a tricycle landing gear, the nose wheel of which folds forwards, while the main gear retracts inwards into the fuselage.

In addition to powerful armament including cannon, bombs and rocket projectiles, the Saab-32 features comprehensive electronic equipment for navigation and combat in all kinds of weather and at night. The triangular fin under the fuselage nose is one of the aircraft's many aerials, the others being completely submerged. The crew consists of a pilot and a radar operator seated in tandem in a pressurized cockpit equipped with ejector seats.

Mr. Lars Brising, Chief Engineer, was responsible for the technical work in connection with the Saab-32, which is the greatest design task ever accomplished by the Swedish aircraft industry. The project engineer for the aircraft was Mr. Arthur Bråsjö. Hundreds of technicians have taken part in the work, for which the research resources of the Aeronautical Research Institute and the Royal Institute of Technology have been used. Flight tests now under way are in the hands of Mr. B. R. Olow, Saab Chief Test Pilot.

With the appearance of the Saab-32, the Swedish aircraft industry has completed another important phase in the programme for supplying Sweden's Air Force with increasingly modern and efficient equipment.

Commandant le Gleuher describes the plan of campaign to reporters with the aid of a road map.

The "traffic cop'ter" reports for duty . ..

... and is soon at work over a congested road junction.

Discussion of the campaign with General Serignan.

"Traffic Cop'ters"

BY LUCIEN ROLLET, PARIS

The French motorist is proverbially a fast and skilful driver. Nevertheless road traffic has increased so rapidly during recent years, especially in and around Paris, that its regulation is becoming a bigger and bigger headache to the Police. Visitors to Paris are well acquainted with the streams of cars which make it almost impossible for the timid pedestrian to cross the road unless he can persuade a policeman to take pity on him and hold up the traffic for a moment. Outside, on the approaches to Paris, the problem is even more acute, especially on Sunday evenings and after holidays when the whole of Paris seems to be flooding back to the capital at the same time . . .

But let Commandant le Gleuher, of the Traffic Police, describe the situation.

"The Police has been responsible for controlling road traffic ever since the eighteenth century," he pointed out with pride to a press conference at his Trappes headquarters, on the road to Versailles. In those days, of course, "traffic" was not what we understand by the word today. One or two stage coaches, a few country carts, an occasional private carriage—what else ?

"But today," said Commandant le Gleuher, "traffic in the Paris region, particularly at holiday times, is so intense that we of the Police scarcely know whether we are standing on our head or our heels. Our roads turn into torrents which completely swamp even the most elaborate control arrangements."

"A swollen river can overflow its banks, but a road swollen with cars cannot. The result is indescribable traffic jams, which are especially bad here in Trappes where two main roads join. During the holiday season they become practically impassible in the evening."

Small wonder that the Police have been looking around for some new method to help them out of their difficulty. They had tried regulating the traffic, without marked success, with the aid of motor-cycles and loudspeakers. But what was needed was something that could watch approaching traffic ten to fifteen minutes before it reached the congested areas.

And here the idea of using a helicopter was born.

The great experiment was tried out on the final evening of a three-day holiday in August, when conditions could be expected to be the worst possible. A whole battery of police and of mechanical traffic regulators was mobilized to filter the streams of vehicles along secondary roads, following instructions from the helicopter.

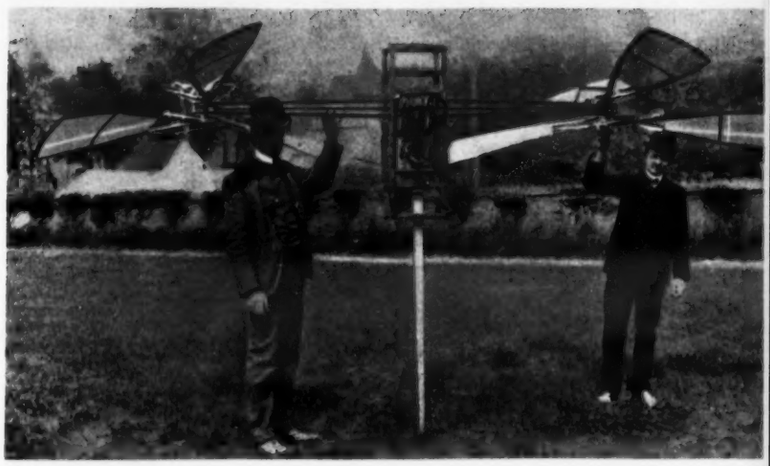
The latter, piloted by Commandant Maurice, circled the chosen traffic centre, like a bee round a honey pot, while the observer, Commandant Fouche, watched the surrounding roads and radioed the police on the ground which roads to close and which to open.

The experiment was a complete success, and thousands of motorists were able to reach the French capital that evening with quite unaccustomed ease. These results should encourage the police to repeat the experiment and use "traffic cop'ters" wherever more conventional methods prove inadequate to cope with traffic congestion.

The Dufaux Helicopter

BY H. LACROIX, GENEVA

The problems of the helicopter were first investigated early in the century by the brothers Henri and Armand Dufaux, of Geneva, who made tests with the mock-up of a helicopter at the Bâtiment Electoral, Geneva, from April 13th to 17th, and in Paris from May 12th to 14th, 1905. We feel we cannot do better than reproduce here part of an article in the "Aérophile" of those days, in which A. de Masfrand describes these experiments.



The Dufaux helicopter, which was tried out in Geneva and Paris in 1905, was part of a larger design. The machine projected would today be known as a "convertaplane."

"It was in Geneva that the Dufaux brothers made their first experiments a few weeks ago (see 'Aérophile' for April 1905, p. 96), after long and patient research. These experiments were crowned with success. However the inventors felt that their success should be confirmed on a larger scene. The Aero Club of France therefore, at their request, made available to them the immense hangar at its balloon station on the slopes of Saint Cloud. And it was here that the second series of tests was made on May 12th, 13th and 14th, in the presence of all the scientists, engineers and sportsmen of Paris interested in the question.

Here is the ingenious and elegant method adopted by the Dufaux brothers for their experiments. An endless cable was held taut on four pulleys made of front bicycle wheels (without tyres). Two of these pulleys were fixed by their forks to the roof beam and the two others fixed to heavy beams on the ground, symmetrically underneath the first in the same vertical plane. The machine, supported by a kind of reinforced wooden cage enclosing the motor, was attached to the cable on one of the 60-ft long vertical sides of the quadrilateral. Thus the machine could rise vertically under its own power but was guided by the cable.

The helicopter rested on the ground on a triangular hollow wooden block fixed to the cage surrounding the engine. This block raised it to the height of a man, to provide better access. M. Armand Dufaux set the engine running by means of a piece of cord, and engaged the rotors. Immediately the machine rose smoothly in the vertical plane up to the hangar roof, where it would have crashed into the rafters if the Dufaux brothers had not stopped its ascent in time by blocking the cable.

Twenty, thirty times and more the experiment was repeated during these three days of public trials . . . as often as the delighted spectators requested. Each attempt brought the same success and the same unanimous applause.

What was even more impressive, the experiment was made on numerous occasions with various overloads representing useful load raised by the machine. In our presence these weights went up to 11 pounds. The amazing machine again rose up vertically, without hesitation, though more slowly. With an excess load of 13 lbs. the machine rose to a certain distance only, and then hovered. MM. Dufaux then added another 1 lb. and the helicopter remained stationary without either ascending or descending.

Fourteen pounds! Such is the impressive load which a machine weighing only 35 lbs. itself can hold suspended in the air for an indefinite time. This magnificent result seems fully to justify the great hopes held by aviators!

*

The Dufaux helicopter is only part of a complete flying machine which, with the addition of a fixed plane, will be able to move horizontally in the air. In the Dufaux's full plan the helicopter is designed to replace the various starting devices, such as inclined planes, tractors, etc. used up to the present for launching aeroplanes. Nevertheless they consider that a fixed plane is still indispensable to produce lateral displacement. In this, like the majority of aviators, they agree with what Colonel Renard has written ('Aérophile', December 1903, p. 276): "Fixed planes, which will give such economical lift, are undoubtedly the flying machines of the future, but they need to be fitted with practical take-off and landing equipment such as only propellers, properly employed, can provide. It will probably be these mixed machines which will provide the means of flying rapidly and safely in the future, without the aid of balloons."

A. DE MASFRAND

Despite the good wishes of the writer of the above lines the Dufaux brothers did not continue development of their manned combination aircraft. Instead they built, in 1910, a biplane with traction propeller, in which they were the first to fly across Lake Geneva. They also founded the well-known firm of Motosacoche.

Test installation for the Dufaux helicopter in Geneva's Bâtiment Electoral (April 13th to 17th, 1905).

Book Reviews

Die Entwicklungstendenzen im deutschen Luftverkehr, by Dipl.-Ing. Heinz Röhm. No. 21 in the series of publications on scientific aspects of transport issued by the Nordrhein-Westfalen Ministry of Commerce and Transport. Publisher Ministerial Director Dipl.-Ing. Brandt, Düsseldorf, 1952.

Fifteen years ago it would have seemed impossible that German air transport science would ever have to start again from scratch, but this is just what happened after World War II, when Germany lost her air sovereignty and all air services to and inside Germany were operated by foreign airlines. German scientists have attacked this problem, like so many others, with typical thoroughness. The difficulty of their task is illustrated by the fact that the writer of the present pamphlet had personally to count the number of passengers passing through the various passport control offices to ascertain how many persons crossed the frontier in 1950/51. Differing statistical methods in use in the various Occupation Zones would otherwise have led to overlapping. Like No. 17 in the series of pamphlets published by Dipl.-Ing. Brandt (World Air Freight Traffic and West German Exports), the present publication also represents an indispensable basis for the restoration of German air transport.

He.

Luftfahrtversicherung. By Dr. Ernst A. Kubli.—From the series issued by the University of Zurich's Science of Commerce Seminary. Verlag Schulthess und Co. AG, Zurich, 1952.

A conscientious and exhaustive account of aviation insurance on the *international level* and particularly of the aviation pool has hitherto been lacking. All earlier books have been concerned to a greater or less extent with the insurance institutions of a single country. It is therefore particularly welcome to find that the author of the present work, drawing on the assistance of a large number of insurance experts, has succeeded in clearing up many of the questions hitherto left unanswered. The book, which has a very comprehensive bibliography, is all the more opportune in that the recent conclusion of a new Rome Convention and the planned revision of the Warsaw Convention have made of aviation insurance a focal point of interest. Everybody concerned, theoretically or practically, with the subject will be glad to have this book on his shelves.

He.

Storia delle operazioni aeree nella seconda guerra mondiale, by Rodolfo Gentile. Published by Associazione culturale aeronautica, Rome, 1952.

As indicated by the title, this book describes primarily the air operations of the last war, within the framework of the general conduct of the war: the German campaigns in Poland, Norway and France; the battles for Britain, Crete, North Africa and the North Atlantic; the Anglo-American raids on Germany and the invasion; finally the naval-air war in the Pacific. On the other hand no mention is made of the fighting in Russia—perhaps because the author considers that it was not essentially affected by the air operations on either side... The campaigns and battles that are mentioned are however dealt with in an unusually thorough and knowledgeable manner, with ample use of figures. The development of air war theories before and since the war is also described, and an account given of present air armament. The book will doubtless be of considerable value to staff officers, strategists and historians, but will also be read with interest by the layman.

Ri.

Aircraft Engines of the World 1952, by Paul H. Wilkinson.—Paul H. Wilkinson, New York, 1952; 320 pages, price $12.

The 1952 edition of Wilkinson's aircraft engine yearbook gives details of 60 turbine engines and 66 piston engines.

The chapter on turbine engines includes 13 new types, notably the Allison J-33-A-16 and J-71-A-1, the General Electric J-47-GE-27 and J-73-GE-1, the Westinghouse J-40-WE-6, the Wright J-65-W-1 and the Armstrong-Siddeley "Sapphire." A particularly interesting section is the one on the Solar "Mars" and Turboméca "Artouste" auxiliary turbine power plants, and the "Orédon" and "Palouste" models also made by Turboméca. The newcomer to the chapter on piston engines is the British Napier "Nomad" compound engine.

As in earlier editions, technical data and tables are supplemented by a detailed examination of present development trends in aircraft engines, information on fuels and lubricants, and a list of modern jet-powered aircraft types.

Ba.

Ebene Plattengitter bei Überschallgeschwindigkeit. By Dr. Rashad M. El Badrawy.—No. 19 in the series issued by the Aerodynamic Institute of Zurich Polytechnic. Edited by Prof. Dr. J. Ackeret; Verlag Leeman, Zurich 1952; 90 pages.

In this thesis, which deals exclusively with problems of flow through a cascade of plates in the supersonic range, the author discusses in particular the case of a cascade of flat, infinitely thin plates. It is not until the last chapter (with a view to practical applications) that a plate of finite thickness is dealt with.

Badrawy first calculates lift and drag coefficients for a single plate, using the theories of two-dimensional supersonic flow. He then establishes the interaction between shock waves and expansion waves by the analytical method, thus escaping the inevitable inaccuracies in the graphic method. A definition of the efficiency of the simple supersonic cascade for various angles of blading and of incidence, Schlieren photographs of the flow between two parallel plates at various angles of incidence, and the special case of non-stationary flow through the cascade caused by a sudden change in the angle of incidence, are given separate chapters.

Finally the influence of friction and thickness on the cascade's efficiency is investigated, and a method of estimating the efficiency of a supersonic propeller—in which the author sees a practical application of the theory of the supersonic cascade—is worked out.

Ba.

Der Versuch einer multilateralen Regelung der kommerziellen Rechte des internationalen Luftverkehrs und die schweizerische Luftverkehrspolitik der Nachkriegszeit. (Dissertation.) By Albrecht Keller, Berne, 1952.

This book falls into two parts, one of which deals with a particularly topical problem, which may be called the "central" problem of world aviation since the war: shall thousands of bilateral air agreements be replaced by a single multilateral agreement, which would clear the way for international air transport? More than half of the dissertation (103 out of 180 pages) is given over to a discussion of the present international situation. Justifiably so, since Swiss air transport policies can only be understood against the general world background. However it is doubtful whether the paper in its present form does full justice to its subject. In any case full use has not been made of some of the most recent literature, such as Goedhuis, Alex Meyer on "Le Cabotage Aérien," revue française de droit aérien, etc.—Nevertheless well worth reading.

He.

Books received

Publications scientifiques et techniques du Ministère de l'Air. Distributed by the Service de documentation et d'information technique de l'Aéronautique, Paris:

No. 260. *Contribution à l'étude du coefficient de viscosité des liquides*, by Jacques Huetz.

No. 262. *Contribution à l'étude aérodynamique de l'aile et de l'hélice*, by Maurice Ménard.

No. 263. *Actes du colloque international de mécanique*, Poitiers, 1950, Volume V.—Etudes sur la mécanique générale.

No. 264. *Chronophotographie des vibrations d'un fluide*, by Joseph-Maurice Bourot.

The Advantages of High Aspect Ratios

M. HUREL, Paris

Maurice Hurel served in the French Naval air units during both World Wars, and is a civil aeronautical engineer and test pilot. With Léon Dubois, Chairman of Entreprises Métropolitaines et Coloniales, and himself an engineer, he founded Société des Avions Hurel-Dubois, which has specialized in the production of aircraft of high aspect ratio. Editors.

The following article summarizes the work done by Société des Avions Hurel-Dubois since its foundation. The technical results obtained are due in large part to M. Maxime Robin, the Company's Technical Director, and M. Fernand Huet, head of the Project Office.

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Up to the present the aspect ratios used in aircraft have rarely exceeded 10, except in gliders, and nearly all modern aircraft have cantilever wings.

In my view, this is because the following arguments have been universally accepted :—

a) With increasing aspect ratio the increase in aerodynamic efficiency gets smaller and smaller and finally becomes negligeable. On the other hand the weight of the wing unit, which increases with the 1.5th power of the aspect ratio, rapidly reaches prohibitive proportions.

b) To reduce weight at increased aspect ratios the wing unit can be braced or strutted, but additional drag cancels out and even exceeds the savings in induced drag.

c) High aspect ratios adversely affect flying qualities : spiral stability is more difficult to ensure, lateral manœuvrability is reduced, etc.

d) Bracing improves resistance to bending but not to torsion. Therefore the efficacy of the ailerons at higher speed will be reduced and wing flutter might occur.

e) High aspect ratios also present the following difficulties : centre of gravity travel is very restricted (smaller chord), the wing's great span may be a handicap, de-icing is difficult.

All these arguments have been shown by Société des Avions Hurel-Dubois to be specious.

The aircraft with braced wing of high aspect ratio is indisputably superior to the normal cantilever monoplane from the point of view of operating economy, and may even often have an appreciably higher speed.

Aerodynamic advantages

The two factors affecting aerodynamic design are lift/drag ratio C_z/C_x and " climb factor " C_z^3/C_x^2. Optimum lift/drag ratio determines the economic cruising speed and the angle of initial climb in the case of jet-powered aircraft. The climb factor determines the rate of climb in the case of propeller-driven aircraft.

Let us take a wing unit with modern airfoil section, such as for example the NACA 63.4.420, fitted with high-lift flaps and hence with a L/D ratio and climb factor which vary with the flap deflection.

Assuming a minimum drag coefficient of 0.01 the optimum L/D ratio for an aspect ratio of 1 : 8 is *18* ; it will increase to *32* for an aspect ratio of 1 : 20, to *37* for 1 : 30 and to *45* for 1 : 50. The relevant *climb factors* (C_z^3/C_x^2) would then be 300, 1200, 1800 and 3200 respectively.

These two factors continue to increase (especially the climb factor) even if the aspect ratio exceeds 1 : 80 or 1 : 100. For an aspect ratio of 1 : 100—supposing such a wing could be built—L/D ratio would be 60 and climb factor 6000.

The gain in efficiency is thus substantial (answer to argument *a*) ; it increases as the profile drag of the airfoil and the parasite drag of the aircraft decrease.

Such high aspect ratios can obviously be obtained only with the aid of bracing or strutting, whose drag must obviously be as low as possible.

Hurel-Dubois' wing designs

Hurel-Dubois' wing designs which have been patented in France and elsewhere, incorporate specially designed struts, high aspect ratio and high-lift devices with low profile drag.

Struts : the manufacture of a strut-braced wing raises two problems :

1) induced drag due to reciprocal induction of wing and strut which form a biplane.
2) increased profile drag due to interaction.

Induced drag : A theoretical study made by Romani, head of the Scientific and Technical Office, shows that it is possible (assuming that for reasons of structural simplicity the portion of the wing between the struts has a constant profile and angle of incidence) to " twist " the strut in such a way that the equivalent aspect ratio of the " biplane " in question is very close to that of the wing by itself.

These calculations were made on a wing with an aspect ratio of 32.5 combined with struts with an area equal to roughly a quarter of the wing area. The equivalent aspect ratio of this " biplane " was 26.5. It was found that if the outer portions of the wing and the strut are appropriately designed, the " biplane's " equivalent aspect ratio in cruising flight will be between 29 and 30. This means a reduction of no more than 8 % over the aspect ratio of the wing alone *(fig. 1)*.

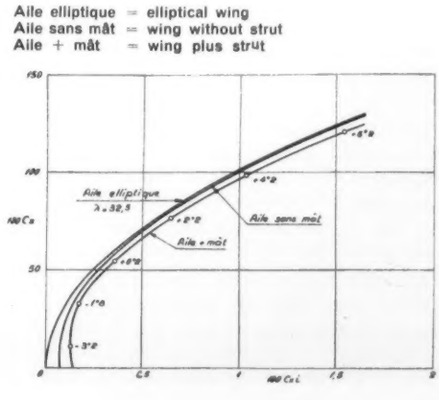
Fig. 2 shows that even at the lift values where minimum induced drag was sought (between 0.8 and 1.2), the twist given to the strut still left it with an appreciable lift.

However, this is not the only solution. It is also possible, for example, to arrange the strut so that, for a given total lift, it will itself have no lift. In this case the equivalent aspect ratio of the " biplane " is equal to that of the wing alone and would not vary much for neighbouring flight conditions.

Profile drag : it appears to be universally accepted as inevitable that an inclined strut causes violent eddies in the neighbourhood of the point where it joins the wing, and that this increases parasite drag. Tests at Hurel-Dubois have shown that these difficulties can be overcome if the following precautions are observed :—

— the strut should be as thin as possible (since there is no danger of buckling in the vicinity of the wing, thickness need be calculated only for pure compression and tensile stress).

Fig. 1. — Polars of a wing with aspect ratio of 32.5.



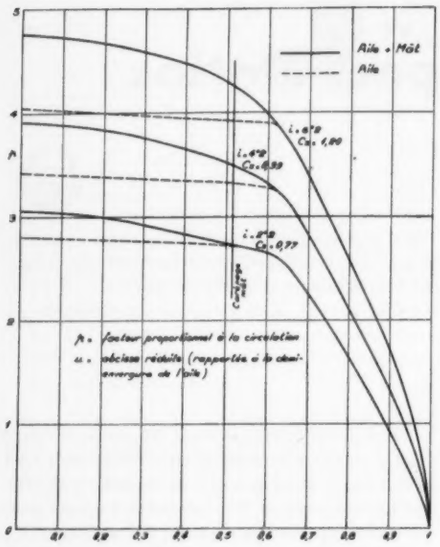


Fig. 2. — Distribution of lift over the span.

Aile + mât = wing plus strut
Aile = wing
Carénage mât = strut cover
p = factor proportional to lift creation
u = abscissa of half span

— incidence and profile of the strut must follow the lines of flow in the region considered. As this profile is practically symmetrical, this latter condition means that the strut's local lift must be practically zero, as is also required by the induced drag conditions. Tests to measure wake at the Saint-Cyr wind tunnel showed that this strutted airfoil (NACA 63.4.420) has practically no interference drag *(fig. 3)*.

If the strutted wing unit is compared with the cantilever monoplane of the same span and area, its minimum drag is practically the same as the latter's, the equivalent aspect ratio is intermediate between that of the equivalent monoplane and that of the upper wing and can be made to approach as closely as desired to the latter if the wing centre section is twisted (answer to argument *b* above).

All these results have been confirmed by tests on a full-size wing unit at Chalais-Meudon wind tunnel, where the strutted wing was found to have an optimum L/D ratio of 32, and by tests on a quarter-size model of the HD 10 aircraft at the Toulouse S5 wind tunnel. The latter showed that the L/D ratio for the whole aircraft was 27, and for lift coefficient 2 with flaps open was 22.

High aspect ratios : the figures quoted show that high aspect ratios enable substantial L/D ratios to be obtained. The presence of the struts permits the aspect ratio to be doubled or even trebled without excessive increase in the weight of the wing, as seen in *fig. 4*, and also enables a lift-drag ratio of approximately 40 to be obtained.

High-lift devices : when special Fowler flaps, which give high lift with low profile drag, are fitted to wings of high aspect ratio, it is possible not only to reach but also to exceed the L/D ratio of 40 obtained with the original airfoil, at very high lift coefficients of the order of 2.5. The climb factor C_z^3/C_x^2 will then reach 4000, although normal values are about 300.

By using boundary layer absorption or expulsion (or a combined system) even better results will doubtless be possible.

Practical results

The aspect ratio of a wing can be doubled without increasing its weight. There may however also be advantage in increasing the aspect ratio still further, even at the cost of an increase in weight, which would in any case be a small one in relation to the total extra weight permissible. The aircraft's useful load can then be doubled or even trebled for the same power and the same speed.

As is known, ICAO stipulates a minimum value for rate of climb in different cases, in particular the case of an engine failing during take-off. This is also the condition which determines the gross weight of an aircraft for a given power and a given wing area.

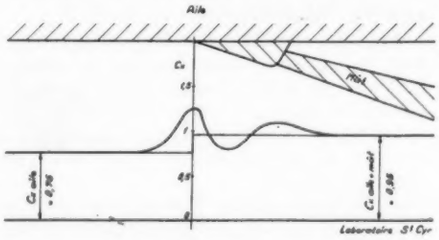


Fig. 3. — Profile drag obtained by wake measurements of the strutted wing. Interference drag is practically negligeable.

C_z aile = wing lift
C_x aile + mât = lift, wing and strut
aile = wing
mât = strut

For example, a normal aircraft with a wing loading of 200 kg/m² cannot exceed a power loading of 6 kg/HP. With the devices described above, and in particular thanks to the very great increase in climb factor C_z^3/C_x^2, ICAO conditions can be met with a power loading of over 10 kg/HP, still with the same wing loading of 200 kg/m². Conversely, retaining the power loading at 6 kg/HP, it would be possible to push the wing loading up to 400 kg/m². This would not increase the take-off run.

To sum up, the increase in performance provided by the Hurel-Dubois formula may be in the form of (1) double or treble the useful load ; (2) a 30 or 40% increase in cruising speed, or (3) a combination of both. In all cases, however, there will be a *very substantial reduction in cost.*

An interesting point is that this increased performance is not limited to a single category of aircraft or a single propulsion system, as is clearly shown by the comparison between aircraft with different kinds of engines.

The HD 10 experimental aircraft

This aircraft (fig. 5) was designed for testing in flight the aerodynamic qualities of a

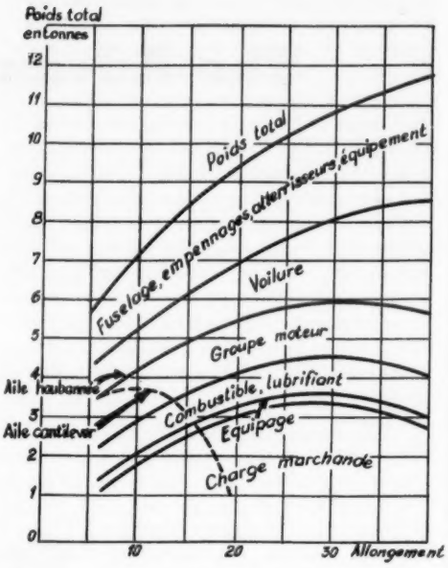


Fig. 4. — Weight estimate as a function of aspect ratio for a number of aircraft of the same power (1200 h.p.), wing area (72 m²) and range.

Poids total = gross weight
Fuselage, empennages = fuselage, tail surfaces
Atterrisseurs, équipement = undercarriage, equipment
Voilure = wing unit
Aile haubannée = strutted wing
Aile cantilever = cantilever wing
Groupe moteur = power plant
Combustible, lubrifiant = fuel and lubricant
Equipage = crew
Charge marchande = payload
Poids total en tonnes = gross weight in tonnes
Allongement = aspect ratio.

strutted wing with high aspect ratio, its structural strength, its resistance to flutter and the flying qualities to be expected of such a wing unit. The wing fitted is the one already tested in the Chalais-Meudon wind tunnel.

Characteristics of the HD 10

Wing area	4.46 m²
Aspect ratio	32.5
Wing Chord	0.40 m.
Area of struts	1 m²
Geometrical aspect ratio	26.5
Mathis engine	40 h.p. at 2800 r.p.m.
Permissible gross weight	522 kg
Wing loading	117 kg/m²
Power loading	13 kg/h.p.
P^3/W^2S	20,000

A striking fact here is the high value for P^3/W^2S (power loading squared times wing loading), which can only be obtained with a particularly favourable optimum *climb factor* (to which it is proportional).

Performance obtained :

Maximum speed	210 km/h
Ceiling	5000 m
Rate of climb	2 m/sec
Power required in level flight	15 h.p.

The climb factor for the whole aircraft reaches 620, whereas it is barely 200 in normal aircraft of the same category. No flutter was experienced at high speeds (up to 122.5% of the maximum level speed).

This is due primarily to the fact that the wing is of box construction, of high resistance to torsion. The strut is fixed to the wing

Fig. 5. — The Hurel-Dubois HD 10 single-engined experimental aircraft.

at two points and thus relieves the centre section of the wing of a large portion of the torsion moment. Ground tests have shown that the frequency of bending oscillations is 6 c/sec and that of torsion oscillations 122 c/sec. This practically eliminates the risk of combined oscillations (answer to argument *d*).

The HD 10's flying qualities were tried out extremely thoroughly by a number of test pilots. Their official reports stressed that :—

— The aircraft is quite safe in a stall. With stick right back the aircraft goes nose down, remaining controllable about all three axes.

— Response to controls is immediate, particularly in yawing.

— Lateral manœuvrability is " surprising ". Aileron efficiency is high and roll damping relatively low.

These qualities are due to the fact that a correct lift distribution along the wing span causes the break-away of the flow to begin in the centre section and that the wing is particularly resistant to torsion (answer to argument *c*).

Variations in the centre of gravity over more than 50% of the chord could be made without adverse effects. This shows the usual practice of fixing the c.g. in terms of percentage of wing chord to be arbitrary. Aircraft with high aspect ratio are more adaptable in this respect than normal aircraft.

As for the question of *de-icing*, there is no reason why any of the methods that have already proved satisfactory in other aircraft should not also be applied to wings of high aspect ratio. And the objection that the large span would make the aircraft cumbersome has also been overcome. The span is not excessive for heavy aircraft, being 45 m. for a gross weight of 35 to 40 tonnes, assuming an aspect ratio of 20 (answer to argument *e*).

The HD 31 and HD 32 twin-engined aircraft

As the official tests on the HD 10 experimental single-engined model had proved the qualities of wings with high aspect ratios, the French Government placed an order for a prototype of the HD 31 *(fig 7)* with two 800 h.p. Wright engines, and later for its derivative, the HD 32, with two 1200 h.p. Pratt & Whitney engines.

Characteristics and performance

Wing area	100 m²
Aspect ratio	20.2
Maximum chord	2.4 m
Airfoil	NACA 63.4.420
Double Fowler flaps	Over 70% of span
Area of struts	19.4 m²
Length of fuselage	22 m
Width of fuselage	2.6 m
Height of fuselage	3.1 m
Freight hold	10 ×2.2×2 m
Total freight volume	50 m³
Horizontal tailplane area	16 m²
Fin and rudder area	13 m²
Nosewheel undercarriage track	7 m

Power Plant

Two 800 h.p. Wright C.7. B A-1s in the HD 31.
Two 1200 h.p. Pratt & Whitney R-1830s in the HD 32.

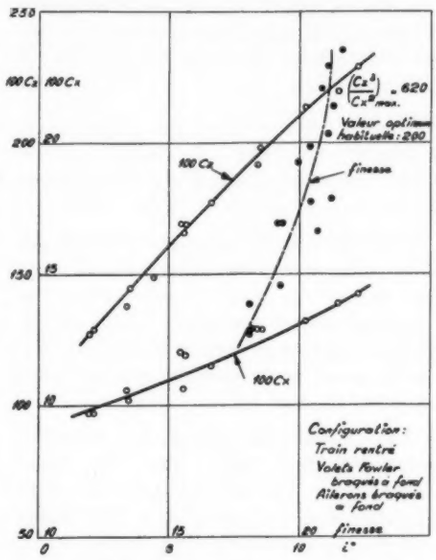


Fig. 6. — Polars of the HD 10 measured in flight with flaps open. An optimum " climb factor " of 620 was obtained, whereas the normal optimum value is 200.

Finesse = lift/drag ratio
Flight conditions : Undercarriage retracted, Fowler flaps fully lowered

The wing is of single-spar construction, with skin bearing only drag and torsion stresses. The strut is hinged to the wing.

The torsional rigidity thus obtained is ample. There is no flutter and no loss in aileron efficacy. Ground tests showed a very great difference between the frequencies of bending and torsion oscillations, so that there is no danger of combined oscillations.

Calculated performance		**HD 31**	**HD 32**
Take-off weight	(kg)	13,500	17,500
Take-off with both engines :			
Take-off speed	(km/h)	124	142
Length of run	(m)	460	570
Distance to clear 15 m	(m)	636	744
Angle of climb	(%)	10.7	11.1
Take-off with failure of one engine :			
Length of run	(m)	460	570
ICAO distance	(m)	950	1,073
Angle of climb	(%)	1.72	1.92
Landing :			
Length of run	(m)	245 [1]	320 [1]
Landing speed	(km/h)	96	110
Flight :			
Max. speed near ground	(km/h)	260	
at engine output of	(h.p.)	2×710	2×1060
Min. cruising speed at 3000 m	(km/h)	—	260
at engine output of	(h.p.)		2×608
Normal cruising speed at 3000 m	(km/h)	240	275
at engine output of	(h.p.)	2×450	5,000
Payload [2] :			
500 km stage	(kg)	4,000	6,050
1000 km stage	(kg)	3,500	5,550
2000 km stage	(kg)	2,500	4,550

[1] with air brakes
[2] including following fuel reserves : 1½ hours of flight at economical output + 10% of fuel carried.

Commercial efficiency of Hurel-Dubois' designs

The commercial efficiency of the HD 32 is compared below with that of the conventional aircraft nearest to it, the world-famed Douglas DC-3, which probably has the optimum efficiency obtainable with cantilever wings. The comparison is made for equal power, take-off run and range. Gross weight for both has been chosen to conform to the French *Air 2050* standard. The HD 32's performance has been calculated and that of the Douglas DC-3 taken from the Douglas manual and from Douglas specification S.M. 3924.

Fig. 7. — Model of the HD 31 twin-engined transport.

The cruising speed of the conventional aircraft is approximately 30% higher than that of the Hurel-Dubois. On the other hand its payload is 48% lower on a 1000-km stage length and 56% less on a 2000-km stage, its direct operating costs per tonne-km are 46% higher for 1000 km and 73% higher for 2000 km.

Turbo-prop and turbojet aircraft

At first sight it seems unlikely that high aspect ratios can provide substantial advantages in aircraft powered by propeller turbines or turbojets.

Aircraft with *propeller turbines* generally have ample thrust for take-off and the gain in aerodynamic efficiency provided by wings of high aspect ratio would appear to be useless. In the case of *turbojets*, the high cruising speed, i.e. low lift and induced drag coefficients, would appear to reduce the value of high aspect ratios.

In reality, as the Institut Français du Transport Aérien has shown in its report No. 192-193 (December 1950), high aspect ratios procure the following advantages in turboprop or turbojet aircraft.

Cruising altitude is about 3000 m. higher than for a normal cantilever monoplane. Cruising speed is increased in consequence, as is also propulsion efficiency. This gives a substantial saving in fuel.

In turbojet-powered aircraft *take-off run* can be considerably reduced, when the high-lift flaps are fully deflected, and gross weight increased by approximately 30%. Cruising speed can also be increased.

Turboprop-powered transport aircraft

The two aircraft compared below are each fitted with two Armstrong-Siddeley " Double Mamba " propeller turbines. Power, payload and stage length chosen are the same. Gross weight is regarded as not being limited by take-off or landing conditions.

The conventional aircraft's efficiency is distinctly inferior to that of the Hurel-Dubois model. Its cruising speed is 63 km/h lower and direct operating costs per tonne-km 25% higher.

PISTON-ENGINED AIRCRAFT

		HD 32 $S = 100\ m^2$ $\lambda = 20.2$ 2 × R-1830		DC-3 $S = 91.7\ m^2$ $\lambda = 9.15$ 2 × R-1830		Limit values under Air 2050
Permissible take-off weight	kg	17,500		12,730		
ICAO take-off distance on one engine	m	1,073		1,740		
Angle of climb near ground (undercarriage lowered, one propeller windmilling)	%	1.24		0.3		0.3
Angle of climb at 120 m (undercarriage retracted, one propeller feathered)	%	1.92		2.32		1.7
Angle of climb at 450 m (beginning of cruising flight)	%	0.56		0.9		0.5
Cruising speed	km/h	260		294		
Cruising altitude	m	3,000		3,000		
Stage length	km	1000	2000	1000	2000	
Payload	kg	5,550	4,550	2,920	2,010	
Cost per tonne-km (HD 32 as unit)		1	1	1.46	1.73	

Jet-powered transport aircraft

In the two preceding comparisons the conventional aircraft is an existing model or one derived from an existing model. Here however both the Hurel-Dubois and the conventional jet transport are projects designed to give minimum cost per tonne-km. Dimensions, aspect ratio etc. have thus been chosen on the same principle, and the comparison between the two designs can be extremely exact.

Figs. 8, 9 and 10 show graphs made during these calculations. Wing area and aspect ratio of both aircraft are varied within certain limits.

The two aircraft compared are a Hurel-Dubois fitted with two ATAR 101 D turbojets of 2800 kg static thrust, and a conventional aircraft with three ATAR 101 Ds. Payload and stage length are assumed to be the same, and maximum runway length taken to be 1500 m.

The conventional aircraft has a cruising speed 90 km/h higher than the Hurel-Dubois. On the other hand its direct operating cost per tonne-km is 30% higher, and its purchase price 40% higher.

*

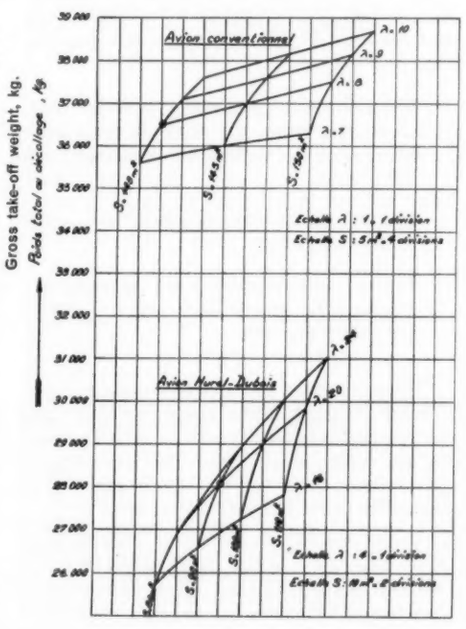
The advantages of the Hurel-Dubois layout are essentially due to the increase in lift/drag ratio and climb factor on take-off and in cruising provided by the high aspect ratio wing.

They are much more marked in the case of take-off, landing or flight with failure of one engine, but regardless of whether these advantages are obtained in take-off, in cruising or in both, they always find expression in a substantial reduction in costs per tonne-km.

Other applications

It is not claimed that all subsonic aircraft would benefit from strutted wings of high aspect ratio, but there are certain cases

Fig. 8. — Gross weight versus wing area and aspect ratio for a conventional aircraft (above) and Hurel-Dubois aircraft (below).



PROPELLER TURBINE AIRCRAFT

		Hurel-Dubois aircraft $S = 65\ m^2$ $\lambda = 24$ 2×Double Mamba	Conventional aircraft $S = 86.2\ m^2$ $\lambda = 8.4$ 2×Double Mamba
Stage length	km	2 000	2 000
Take-off weight	kg	21,200	23,400
Weight of fuel consumed	kg	2,820	4,050
Cruising altitude	m	10,500	7,650
Cruising speed	km/h	578	515
Payload	kg	51,000	5,000
Cost per tonne-km (HD aircraft as unit)		1	1.25

TURBOJET AIRCRAFT

		Hurel-Dubois aircraft $S = 90\ m^2$ $\lambda = 20$ 2 × ATAR 101 D jets	Conventional aircraft $S = 140\ m^2$ $\lambda = 8$ 3 × ATAR 101 D jets
Stage length	km	1,500	1,500
Permissible take-off weight	kg	28,100	36,500
ICAO runway length	m	1,500	1,500
Weight of fuel consumed	kg	5,120	7,335
Cruising altitude	m	12,400	11,900
Cruising speed	km/h	700	790
Payload	kg	5,710	5,670
Cost of aircraft (HD aircraft as unit)		1	1.4
Cost per tonne-km (HD aircraft as unit)		1	1.3

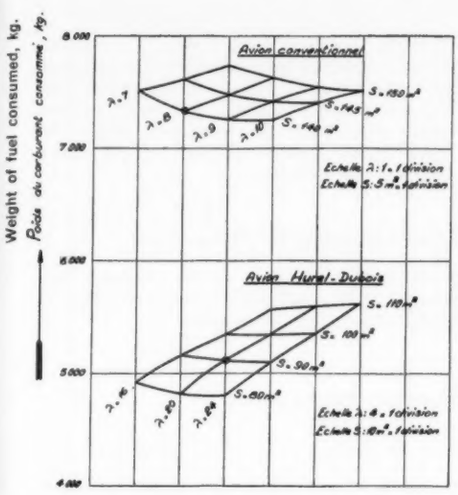


Fig. 9. — Weight of fuel consumed versus wing area and aspect ratio for conventional aircraft (above) and Hurel-Dubois aircraft (below).

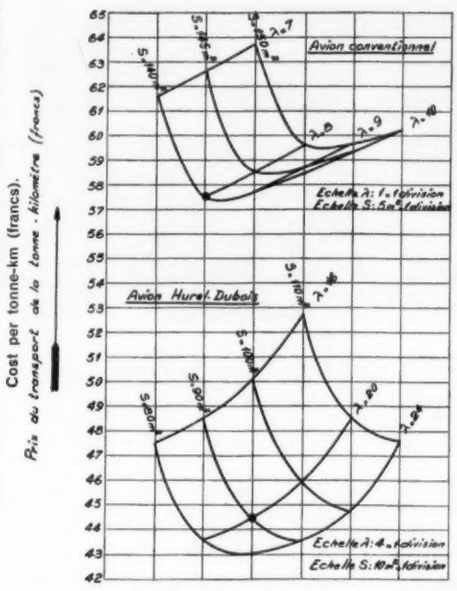


Fig. 10. — Operating cost per tonne-km versus wing area and aspect ratio for conventional aircraft (above) and Hurel-Dubois aircraft (below).

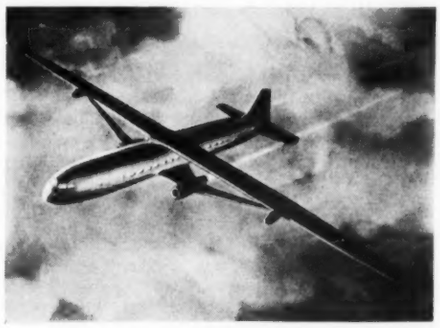
where their adoption would be particularly advantageous.

Military transports, which have to cope with the same problems as civilian transports, should use the same solutions. In addition, the advantage of being able to take off at low speed is particularly valuable to the *assault transport*. *Naval patrol aircraft* could have their fuel load doubled, consumption reduced and endurance more than doubled. *Bombers* would get a greatly increased load, or a better ceiling or range.

It now remains to try and forecast the future of these wings and how they will react to very high speeds. It is already known that although passage through the transonic range is particularly unpleasant, high aspect ratio wings regain all their qualities in the supersonic range. But in order to take advantage of them lift coefficients must be relatively high (approx. 0.5), and this can only be obtained by combining very high altitudes (over 20,000 m) with very high wing loadings (over 1000 kg/m²).

It would therefore seem likely that the 1800-km/h aircraft will have a strutted wing, of relatively small thickness and medium aspect ratio.

Fig. 11. — Hurel-Dubois HD 45 twin-jet transport.



What's in the Air ? *

POLITICAL

C.A.B.'s Nyrop resigns

● *Donald W. Nyrop* resigned his chairmanship of the U.S. Civil Aeronautics Board at the end of October. Reason : pressure of work ; though it has also been rumoured that relations with other members of the board had been strained during recent months. Nyrop, who had held this post since May 1951 and was generally regarded as the most capable Chairman C.A.B. had ever had, is being replaced provisionally by Oswald Ryan, hitherto Vice-Chairman. The permanent Chairman will be appointed in January, after the new American Government takes office.

East German army being organized

● The Eastern Powers' *Permanent Defence Committee*, created in August 1952, is headed by Russia's Marshal Bulganin, has its secretariat in Prague and counts Russia, Poland, Czechoslovakia, Hungary, Rumania, Bulgaria and Communist China among its members.— Meanwhile the East German People's Republic has set up what is virtually a *defence ministry* and *armed services*. The head of the latter (he does not officially bear the title of commander-in-chief) is *General Vincenz Müller*, who formerly commanded the 12th German Army Corps and later joined the " Free Germany " Committee formed in Moscow after Stalingrad. The projected commander of the *East German air force* is *General Heinz Kessler*, formerly a private soldier who deserted to the Russians. He is said to have commanded training schools in Russia.

AIRCRAFT INDUSTRY

Ten Billion Dollars for USAF Jet Bombers

● The U.S. Air Force is to spend a total of $10,000,000,000 on its Boeing B-47 " *Stratojet* " (six jets) and B-52 " *Stratofortress* " (eight jets) programme. Up to the present the Air Force has received around 300 " *Stratojets* ", making it the most widely-used in Strategic Air Command.

Colonel Etienne Primault has been appointed to command the Swiss Air Force and Anti-Aircraft units, with the rank of *Divisional Colonel*. He replaces Divisional Colonel Friedrich Rihner.

* Extracts from "Interavia Air Letter", international daily news digest, in English, French and German. All rights reserved.

... And $ 1,000,000,000 for helicopters

● The *U.S. Army* is asking for $200,000,000 for the 1953-54 fiscal year for research and purchase of *4000 helicopters*. Construction of the Army's *first heliport* is to begin at Fort Eustis (Va.) early in 1953.—According to Washington sources, total expenditure on military helicopters in the 1953/54 budget, including allocations for the U.S. Air Force and Navy, will be close to *$1,000,000,000*.

America buys "Comets"

● *Pan American World Airways* has ordered three de Havilland "Comet 3s", and taken an option on another seven for delivery in 1957. — The *Royal Canadian Air Force* has bought two "Comets" equipped as military transports. — The Society of British Aircraft Constructors announces that so far a total of *52 firm orders* (British and foreign) has been received for the "Comet".

AIR TRANSPORTATION

Air France's traffic increase

● *Air France's provisional figures* for the first nine months of 1952 show a *considerable advance* over 1951. The figure of 1,090,000,000 passenger-km. was reached by the end of September and results for the whole of 1951 thus surpassed.

SAS Polar service

● It was revealed on October 22nd that negotiations between Sweden, Norway and Denmark on the one hand and the United States on the other on the use of the U.S. Air Force's base at Thule, Greenland, as technical point of call on Scandinavian Airlines System's projected trans-Polar passenger services to the United States, were to begin in November. Three cities in the United States, San Francisco, Chicago and New York, are under discussion as possible terminals. Meanwhile SAS already has permission to ferry two of its new DC-6Bs from California to Scandinavia over this projected route.

German air freight volume

● *Airports in Western Germany* recorded a total air freight volume of 48,800,000 kg for the period January to September 1952, compared with 28,400,000 kg during the same period last year. *Total increase thus 65%*.

Passenger cabin in SNCA du Sud-Ouest's SE 2010 "Armagnac", which the French airline Cie. des Transports Aériens Intercontinentaux is using on its Paris-Casablanca-Canaries and Casablanca-Brazzaville services (84 passengers on first-class, 107 on second class services).

Banks finance aircraft procurement

● *Eastern Air Lines* (one of America's "big five" airlines; president: Eddie V. Rickenbacker) has obtained a further *$10,000,000* to finance its fleet expansion programme, by selling 3¼% notes to a group of banks headed by the Chase National Bank. EAL had already obtained a credit of $30,000,000 from the same group in September 1950. Eastern is now rather over half-way through its $100,000,000 re-equipment programme.

● *National Airlines*, a rapidly-expanding carrier, has arranged for a seven-year loan of $12,000,000 at 3½% from a group of banks in New York and Miami, to be used towards the purchase of eight Douglas DC-6Bs, four DC-7s and eight Convair 340s.

SERVICE AVIATION

R.A.F. gets "Sabres"

● The British Air Ministry announced early in November that the Royal Air Force was shortly to receive the first of between *300 and 400 North American F-86 "Sabres"* promised under a tri-partite agreement with Canada and the United States. Canada is to supply the airframes (Canadair Ltd.) and some of the engines and electronic equipment, while the United States contributes most of the power plant and instruments.

Piasecki helicopters for French Navy

● The French Navy is to be supplied with Piasecki HUP-2 helicopters, under the Mutual Defence Assistance Programme.

FLYING EQUIPMENT

First Flights

● *Douglas Aircraft Co.* reports that the *Douglas X-3* high-speed experimental aircraft made its first flight in mid-October. Although few details of this aircraft are available, it would appear that the X-3 has been fitted with *two turbojets* (Westinghouse J-40s ?) for its first test flights. For the high-speed test programme proper, higher-powered engines (possibly rocket engines) are expected to be fitted.—The X-3 is built primarily of heat-resistant steels and is said to reach speeds of over 2000 m.p.h. and altitudes of over 150,000 ft.

● The prototype of the *Douglas XA3D-1* swept-wing carrier-based bomber took off on its first flight on October 28th.

● On October 16th the prototype of the *SO 4050 "Vautour"* twin-engined general-purpose aircraft began flight tests at Melun-Villaroche. The SO 4050, designed by Engineer Parot of SNCA du Sud-Ouest, was built in only 14 months. The first flight was made five weeks after assembly, several weeks ahead of schedule.

Orders

● The *McDonnell F-101* has been ordered into production. Size of the contract for this 700+ m.p.h. jet fighter is not disclosed.

● The *Convair F-102A* delta-wing supersonic interceptor is also to be built in quantity. It is to be fitted with two Pratt & Whitney J-57 turbojets of 10,000 lbs static thrust (or 13,500 lbs with afterburning). Armament: *Hughes XF-98 "Falcon" air-to-air missile.*

● *Douglas Aircraft Co.* is to build the F4D-1 "Skyray" jet fighter in quantity for the U.S. Navy.—*North American* reports a U.S. Air Force order for the *F-100 swept-wing fighter.*

Board of *Associazione Imprese Aeronautiche* (Italian aircraft manufacturers' association) at a meeting during Turin's Second International Technical Show (September 27th to October 9th). Left to right: Campanini (Oleodinamica Magnaghi); Magnaghi and Rossati (Alfa Romeo); Berretta (Fiat); Foresio (Aeronautica Macchi); Armando Piaggio; General Bruno (chairman of AIA); Sacchi (AIA director for Milan); Zavattaro (Fabbrica Italiana Magneti Marelli); Derossi (Microtecnica); Gelmi (Breda); Casiraghi (Piaggio & C.).

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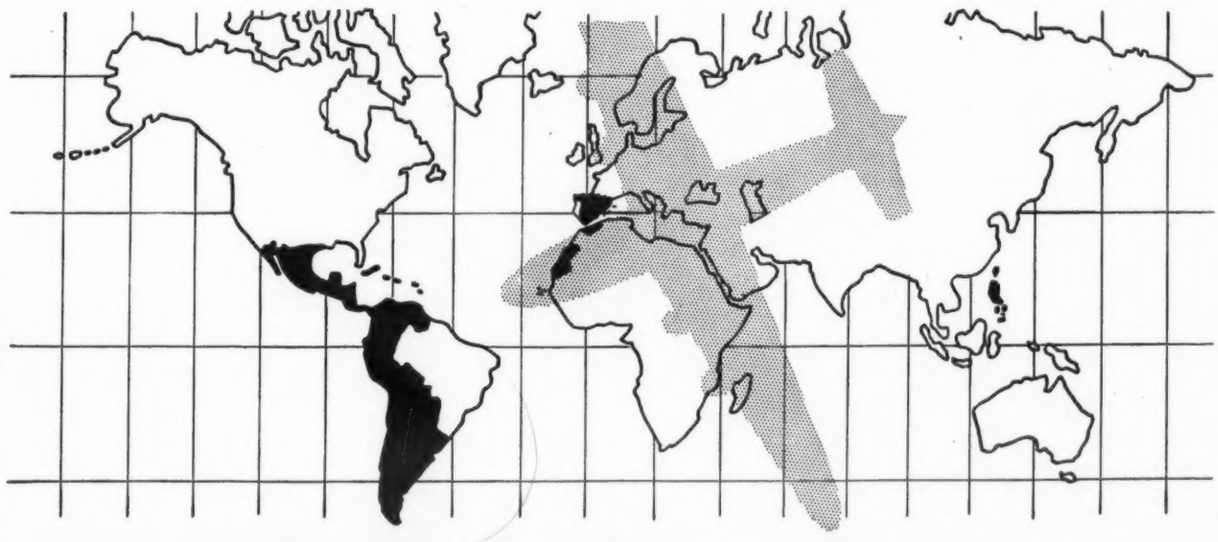

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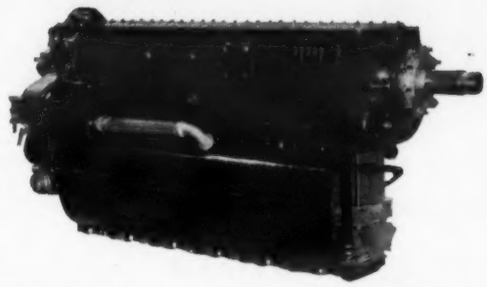

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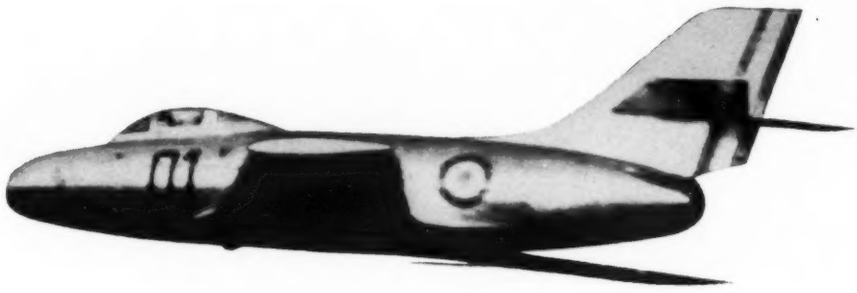

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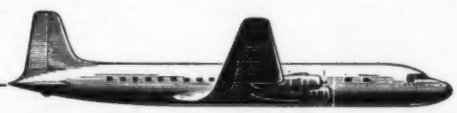

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